Derwent World Patents Index

Polymer Indexing System Description

Derwent
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Polymer Indexing System Description

Introduction

Since 1966, Polymer information has been indexed in Derwent World Patents Index from patents classified in Section A. The original Plasdoc Code, as it was then known, has undergone many changes since its introduction. The aim of the system, however, remains the same and that is to handle polymer information in the patent literature.

The first system was the Plasdoc punch code, and these codes were based upon punch positions on a punch card. Concepts were represented by groups of these punch codes, but this led to false drops and poor relevance in searching. In 1978, Key Serial numbers (KS) were created from precoordinated groups of punch codes. The obvious benefit of these Key Serials was the ability to search specifically for those concepts to which they had been assigned. Plasdoc Registry Compounds, with corresponding Registry Numbers (RN) were incorporated into the system in 1984. These compounds represented the most commonly occurring additives and catalysts in polymers and allowed them to be searched for specifically.

The most far-reaching changes to the indexing of polymers occurred in 1993, with the introduction of the Enhanced Polymer Indexing System. This system is based on the hierarchical structure existing in the previous systems, but has combined the benefits of all of them. Specific compounds are represented by Specific Compound Numbers, generic codes have been incorporated within the hierarchical structure to retain the ability to search generically, and chemical aspects have been introduced to provide the ability to create searches by combining chemical functional features. Thus, the Enhanced Polymer Indexing System has been designed for both specific and generic searching of compounds encountered in the polymer area. In addition, a sophisticated system of linking has been implemented to provide the searching precision and flexibility required in such a complex technology.

Coverage

The Polymer Index covers the area of technology relating to polymers, plastics, resins and rubbers. Indexing is based on the patent specification and covers all the claims, claim–related examples, and information from the documentation abstract.

The specific areas covered are:

Polymers - including natural polymers and modified polymers

- Polymer formers
- Chemical processes for the production and modification of polymers
- Chemical processes for the production of polymer formers
- Polymerisation processes
- Physical operations
- Shape & form
- Properties
- Applications

Modifying agents

- Shape & form of modifying agents where important
- Properties of modifying agents where important

Additives - for polymers by chemical structure and by function

- Shape & form of additives where important
- Chemical processes for production of additives and catalysts for these processes
- Physical operations

Catalysts - for polymerisation, polymer modification, polymer former preparation and additive preparation

- Catalyst by function and by chemical structure
- Shape & form of catalysts where important
- Properties of catalysts where important

Areas not covered are:

- Starting materials for the production of polymer formers and additives
- Generic modifying agents
- Compounds present with polymers which are not additives, catalysts or modifying agents for the polymer
- Chemical processes for the production of non-polymeric catalysts

Overview of the enhanced system

The structure of the Enhanced Polymer Index follows that of the old systems in many ways. The old codes have always been divided into a number of areas of interest, e.g. monomers and condensants, additives, applications and so forth. Basically similar divisions are retained in the Enhanced Polymer Indexing system, in the form of "Facets".

An important primary division, which has been reinforced in the enhanced code, is the separation of chemical and non-chemical information. There are a few terms in existence in the old code which bridge this division, e.g. "carbon black filler", Key Serial (KS) 2217 and there is a great temptation to create more terms of this type, since they solve specific indexing and searching problems very neatly in the short term. Unfortunately, it is not a strategy that can work with large numbers of substances and large numbers of possible activities or functions, so the separation between the chemical and non-chemical areas has been rigorously enforced (e.g. carbon black filler is now Carbon black, R05085 and Filler, A237, linked together).

Therefore, there are two basic sections of the code, the Structural section and the Non-structural section, each of which is further subdivided into Facets as described below:

Structural Section

The structural section contains all the chemical information. The following facets make up the structural section:

- Polymer Formers
- Chemicals
- Natural Polymers
- Polymer Types
- Modified Polymers
- Chemical Aspects

Polymer Formers

The Polymer Formers facet contains concepts for monomers and condensants such as Ethylene, Methyl methacrylate, Propylene oxide, Phosgene. These specific compounds are represented by Specific Compound Numbers (SCN). This facet also contains generic terms for broad types of chemicals used in polymer manufacture, such as Acrylics. These generic concepts are represented by codes of the format Gnnnn. All of the specific compounds within this facet are arranged hierarchically.

Some compounds in this facet can also be found in the Chemicals facet, if they are likely to function as both polymer formers and as additives or catalysts. Examples of these are Tetrahydrofuran and Styrene. The same Specific Compound Number (SCN) or code is used in both occurrences in these cases. The division between Polymer Formers and Chemicals has been made in order to retain the hierarchical structure of the Polymer Formers facet.

Chemicals

The Chemicals (low molecular weight compounds) facet contains all those compounds which commonly occur as additives and catalysts in polymers and plastics. This includes compounds such as Carbon black, Benzoyl peroxide, Titanium trichloride and 2-Hydroxy-4-methoxy benzophenone. As detailed above, some compounds occur in both the Chemicals and the Polymer Formers facet. Also as above, the codes used for concepts in this facet are Specific Compound Numbers and generic codes.

Natural Polymers

The Natural Polymers facet contains such compounds as Starch, Alginic acid and salts, various Cellulose ethers and Cellulose esters within a Polysaccharides hierarchy. It also contains several generically defined compounds such as Bituminous materials, Lignins and Terpene resins. Again the codes used in this facet are Specific Compound Numbers and generic codes.

Polymer Types

Concepts for defining the type of polymer are found within the Polymer Types facet. Some of these are very generic and define the polymer in terms of how it was formed; others are generic descriptions of the repeat unit, such as Polyesters, Polyamides, Polyimides, Polyurethanes. Structure definition here is limited to partial characterisation of the repeating unit. Also included in this facet are codes for specific copolymers, such as Ethylene-vinyl acetate and Styrene-butadiene.

Modified Polymers

These correspond with the chemical processes listed in the Chemical Processes facet (except for the polymerisation terms), but are used when the product of the process is the key inventive feature, rather than the process itself. These terms are also used when a modified polymer is being formed.

Chemical Aspects

This is one of the major improvements provided by the enhancements. The Chemical Aspects have been introduced in order to provide more chemical information for those compounds which have not been assigned a Specific Compound Number. The retrieval of generic concepts and Markush structures will both benefit from the use of these aspects. The Chemical Aspects are applicable to compounds with any function i.e. polymer formers, additives, catalysts, modifying agents, natural polymers and polymer types. Chemical Aspects are also used to code elements incorporated in a polymer by modification. In the previous systems, there are only a few chemical multifacet terms which serve this function.

The Aspects are NOT meant to be a chemical code. They are aimed primarily at generic chemical information - the sort of thing that cannot be expressed in a structure diagram, either because the information is too vague, or more often because it is incomplete. This is a common problem in the area of polymers, and is the reason why we have not provided a detailed chemical code of the type used in Sections BCE.

Non-structural section

The non-structural section contains all the non-chemical information. The following facets make up the non-structural section:

• Novelty Descriptors

• Universal Terms

• Polymer Descriptors

• Shape & Form

• Additives

• Catalysts

• Chemical Processes

• Physical Operations

• Equipment

• Properties

• Applications

The non-structural terms have been expanded, in many cases by the splitting up of combined or precoordinated concepts to provide access to the simpler, more basic terms. In the cases where, for example, a positive and a negative property shared the same code, these have now been divided to create two separate concepts with different codes. The Key Serial 2600 represents both Heat stability and Heat degradability, whereas in the Enhanced Polymer Index there is a unique code for each of these concepts.

Novelty Descriptors

The concepts in this facet are used to indicate the main area(s) of invention of the patent, i.e. the novelty of the patent.

Universal Terms

The Universal Terms facet contains only non-chemical information, and these concepts are searchable with concepts from any other facet. Thus, UV radiation, a concept within the radiation hierarchy in this facet, can be combined with various concepts such as Crosslinking (for a UV crosslinking process), Polymerisation (for UV polymerisation) or with Light stabiliser (for a UV light stabilising additive).

Polymer Descriptors

The Polymer Descriptors facet contains mainly functional concepts for the polymer formers, such as terms for Homopolymer, Polymer former etc. with additional concepts, for example Grafting monomer, Modifying agent and Macromers.

Shape & Form

The Shape & Form facet caters for shape and form of additives, catalysts and modifying agents as well as polymers. Concepts within this facet include terms for fibres such as Chopped fibre, Sheath-core fibre and Continuous fibre. Other concepts include Film, Foam, Particulate form and Solution.

Additives

The Additives facet contains only functional concepts for additives - the chemical information is found in the Chemicals facet and can be searched by linking the function and the compound. There is also a specific term available for additive preparation.

Catalysts

The Catalysts facet contains only functional concepts for catalysts - the chemical information is found in the Chemicals facet and can be searched by linking the function and the compound. The catalyst concepts cover both the type of catalyst and the reaction being catalysed.

Chemical Processes

The Chemical Processes facet contains all the chemical processes applicable to polymers, polymer formers and additives. In addition, it also contains polymerisation terms and these can be used in combination with concepts such as Amidation for condensation polymerisation of a diacid and a diamine to produce a polyamide. There is only one set of polymerisation concepts to cover both addition and condensation type processes. The polymeric products of these chemical processes can be found in the Modified Polymers facet.

Physical Operations

The Physical Operations facet contains all plant operations, moulding processes, shaping and finishing terms. All the concepts relating to coating processes can be found in the Surface treating hierarchy within this facet.

Equipment

The Equipment facet contains only a few concepts, all of which can be used in combination with any other concept, for example, a chemical process or a physical operation.

Properties

The Properties facet is arranged hierarchically; its main function is to describe the properties of a polymer. These terms can be used in conjunction with additives, catalysts and modifying agents but only when the property is important e.g. particle size of a filler. Surface treated concepts, which correspond to the surface treating concepts in the Physical Operations facet, are now to be found in this facet.

Applications

The Applications facet contains a wide range of concepts relating to the final use of the polymer. Concepts include some general terms such as Controlled release devices, Disposable use and Barrier layers. More specific concepts within this facet are Adhesives, Optical discs and Pesticides.

Treatment of Chemical Structures and Polymers

Chemical Structures

To sum up, there are three complementary ways in which chemicals are handled in the Enhanced Polymer Index:

Specific Compound Numbers

Fully defined compounds which are reasonably common have their own codes. We are using a subset of the Specific Compound Numbers (SCNs) used in Sections BCE indexing, and added a number of compounds not generally seen in Sections BCE, but which are important in Polymer Indexing.

Nearly all the compounds in the Chemicals facet are represented by SCNs. Most of the Polymer Formers facet consists of SCNs as well, and there is some overlap, as mentioned previously.

Generic Terms

There is a hierarchy of generic terms based on the old code. Each code denotes a class of chemicals defined by common features of structure. The generic codes all begin with 'G' followed by 4 numerals. These generic codes are found mainly in the Polymer Formers facet, but there are a few in the Chemicals facet.

Chemical Aspects

These cover a variety of fundamental chemical structure features, including:

- General terms - inorganic, organic, hydrocarbon, ..
- Generic sub-units - aliphatic, unsaturated chain, bicyclic heterocyclic, ..
- Number of rings present - 1, 2, 3, 4, ≥5
- Number of atoms in ring - 3 member ring, 5 member ring, ..
- Atoms in heterocyclic ring - N, O, P, >1 S, >1 N, ..
- C-C unsaturation - no unsaturation, acetylenic, diolefinic, terminal olefinic, ..
- Broad functionality types - salt/complex, ester, acid halide, metal-C, ..
- Carbon count - 1C, 2C, 3C, … 12C, 13C - 18C, 19C - 24C, ≥25C
- Acid derivatives - malei-, azelai-, sulphoisophthali-, pyromelliti
- Specific chemical functions, such as epoxide, thiol, amine, diamine, azide, ether, phenolic, sulphonyl, isocyanate….
- Elements and their periodic groups.

Polymers

A polymer can be defined in terms of its starting materials, the product or both. The starting material(s) can be defined in terms of individual compound(s), generic descriptors of a class of compound, Markush structure or combinations of these. Likewise, the formed polymer can have a fully defined structure or only a partially or generically defined structure, which is sufficient to enable it to be assigned to a class of polymer.

Representation as Polymer Formers

Where the information is available, the policy of indexing polymers in terms of the polymer formers, monomers and condensants - will continue, but in all cases either a Polymer Types code or a Polymer Descriptor code will be applied.

For the situations where the polymer formers are not known, one or more Polymer Types code(s) are used along with chemical aspects as applicable.

Within each hierarchy, we have a main generic, such as Monoolefinic, containing other hierarchies, for example, Vinyl aromatics monoolefinic. This hierarchy contains individual polymer formers, for example, alpha-Methyl styrene and Cinnamic acid. In addition, there is a need for 'semi-generic' concepts for certain classes of polymer formers such as Halomethyl styrene. These in turn may also contain specific concepts, in this case Chloromethyl styrene and Bromomethyl styrene. Within any hierarchical system, it is necessary to cater for individual concepts which have not been incorporated. Thus, Vinyl aromatic monoolefinic, other will be used for new specific compounds or those compounds which occur infrequently and do not fit elsewhere within the Vinyl aromatics monoolefinic hierarchy.

G0022		Monoolefinic
		…….
		…….
G0102	NT	Vinyl aromatics monoolefinic
R00708	NT	Styrene
G0113	NT	Vinyl toluenes (gen)
		…….
R00673	NT	alpha-Methyl styrene
G0124	NT	Halomethyl styrene (gen)
G0135	NT	Chloromethyl styrene
G0146	NT	Bromomethyl styrene
		……
R01416	NT	Cinnamic acid
		…….
G0237	NT	Vinyl aromatic monoolefinic, other

Each generic concept and semi-generic concept has been assigned a generic code and each specific concept in the polymer formers hierarchy has been assigned a Specific Compound Number (SCN).

Generally, the indexers will apply the most appropriate codes to express the information contained in the patent, using generic codes and chemical aspects for the generic concepts and for Markush structures in claims, and SCNs for specifically named compounds in claims and examples.

An important aspect of the design is the autoposting of broader terms when narrow or specific terms are entered.

Repeating Units

These are sometimes seen explicitly drawn in patents and then there are usually sufficient details on preparation to permit indexing in terms of monomers and condensants. When this information is not available, we will use the Polymer Types plus all the appropriate chemical aspects. Frequently patents will use standard terms such as 'polyester' and not provide any further information. The commonly occurring standard terms of this type are in the Polymer Types facet. 'Polyester' is used when that is what the patent says. However, the polymer types terms will autopost some aspects. It is also worth noting that we are using the polymer types codes such as Polyester when a polymer production process clearly involves the formation of the functional group concerned, thus a polyester production process will receive the code for polyester.

Searching Polymer Formers or Polymer Types

In the Enhanced Polymer Indexing system there are several methods available for searching for polymers. Whenever possible, polymers are indexed by their polymer formers (i.e. monomers and condensants) in addition to one or more Polymer Types codes.

For Addition Polymers with a Polymer Type concept which fully defines the polymer, searching using Polymer Former(s) linked at level 2 to Polymer Descriptor(s) will give exactly the same results as searching the Polymer Type code.

For example, searching Propylene Homopolymer (R00964 (2) H0000) will give the same results as searching Polypropylene P1343 (i.e. propylene homopolymer). Likewise Styrene - Butadiene block binary copolymer (R00708 (2) R00806 (2) H0044 (2) H0022) will give the same results as P0373 (Styrene - Butadiene block BCP).

The results of these searches carried out on Questel are shown below:

SS	Results	
1	5939	/PI R00964 L H0000
2	5939	/PI P1343
3	0	1 NOT 2

SS	Results	
1	634	/PI R00708 L R00806 L H0044 L H0022
2	634	/PI P0373
3	0	1 NOT 2

In these cases the Polymer Type code is autogenerated from the correctly linked combination of Polymer Former(s) and Polymer Descriptor(s).

However, for Polymer Types such as Linear Low Density Polyethylene (LLDPE) it is not possible to fully define this concept in terms of Polymer Formers. The term LLDPE does not define the other polymer formers present with Ethylene. A search for LLDPE using P1252 will retrieve all types of LLDPE. To retrieve LLDPE from Ethylene (R00326) and Octene-1 (R00936) only, it is necessary to search both the Polymer Formers and the Polymer Type:

Search	Retrieve
(R00326 (2) R00936)	All copolymers containing ethylene and octene-1
(R00326 (2) R00936 (2) H0022)	All binary copolymers containing only ethylene and octene-1
(R00326 (2) R00936 (2) P1252)	All LLDPE polymers containing ethylene and octene and possibly other polymer formers
(R00326 (2) R00936 (2) H0022 (2) P1252)	All LLDPE polymers containing ethylene and octene only

As you can see from the following search results on STN, each strategy becomes slightly more specific.

L1	180	S (R00326 (P) R00936)/PLE
L2	132	S (R00326 (P) R00936 (P) H0022)/PLE
L3	43	S (R00326 (P) R00936 (P) P1252)/PLE
L4	39	S (R00326 (P) R00936 (P) H0022 (P) P1252)/PLE

Concepts which can only be retrieved using Polymer Types codes:

The Polymer Types concepts listed below have no direct equivalent Polymer Formers codes for searching:

P0500   Fluoro resin

P1172   Low density polyethylene

P1183   Medium density polyethylene

P1194   High density polyethylene

P1207   High molecular weight high density polyethylene

P1218   Ultra high molecular weight polyethylene

P1241   Very low density polyethylene

P1252   Linear low density polyethylene

P1309   Ethylene-propylene-diene monomer

P1321   Ethylene-vinyl acetate-vinyl alcohol

P1332   Ethylene-vinyl alcohol

P1718   Vinyl acetate-vinyl alcohol

P1729   Vinyl chloride-vinyl acetate-vinyl alcohol

P1763   High Impact polystyrene

Modified Polymers

The terms in the modified polymers facet can be used either on their own or in combination with polymer formers, polymer types or chemical aspects.

We have also expanded the coverage to include indexing of specific modifying agents for polymers. For this, we index the SCNs, generic codes and/or chemical aspects of compounds which have been exemplified or claimed as such.

Chemical Aspects

In this section we cover the Chemical Aspects in detail, including the rules and definitions used in applying them. For Graphical definitions of the Specific functionality terms, see the Polymer Indexing Reference Manual.

Within the Chemical Aspects facet there are both general terms and specific terms. The general terms (of format Dnn) are applied in the widest reasonable sense; for example, Acid halide (D64) - any acid as conventionally understood is included, and thus the term embraces sulphonyl halides, phosphonyl chlorides etc. The terms acid, base, salt etc. are used in their conventional sense.

General terms

Inorganic compounds are represented by the concept Inorganic (D00) plus the element terms and appropriate specific functionality terms. D61 Salt/complex is not applied to inorganic salts.

Organic compounds are represented by any of the concepts which are applicable, but the element terms for Carbon (C-) and Hydrogen (H-) are not applied to organic compounds.

Bridged ring – must contain 2 atoms with at least 3 paths between them; each path must contain at least 1 atom: e.g. Dicyclopentadiene, Norbornene, Hexamethylene tetramine.

Spiro – rings with only 1 atom in common: e.g. Cyclohexanone peroxide.

Tricyclic ring system and Tetracyclic ring system or higher – apply to fused rings only.

Generic Sub-units

These concepts cover chains, single rings and fused ring systems. A single ring is one in isolation, although there may be more than one in a compound (e.g. Bisphenol A has 2 single rings).

Aspects for fused ring systems are applied hierarchically to a given ring system as follows: -

Heterocyclic

Aromatic

Alicyclic

Thus, if there is one or more heterocycle present, then the concept for Bicyclic heterocyclic or Polycyclic heterocyclic is applicable (regardless of the type of ring it is fused with); if there is no heterocycle present, but one or more aromatic rings present, then the concept for Naphthalene or Polycyclic aromatic is applicable; if there are only alicyclic rings present, then the concept for Bicyclic, Cyclopentadienyl- or Polycyclic is applicable.

Aliphatic chains can contain any amount of branching. A carbon chain consists of atoms joined by C-C, C=C or C≡C.

A carbon chain consists of one or more carbon atoms with no closed paths (i.e. no rings) joined to ring atoms or heteroatom(s). For example, the following compounds all contain a carbon chain.
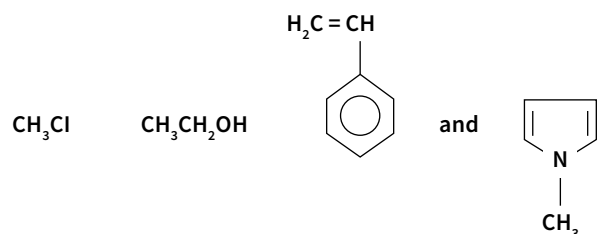
Aromatic is defined as carbocyclic, optionally fused, containing at least 1 benzene ring.

Number of Rings

These concepts are applied to the compound or Markush formula as a whole, for the number of rings, regardless of the type of ring (isolated, fused) and number of ring systems. The number of rings in a ring system is defined as the minimum number of paths which have to be cut to end up with no rings.

For example, if there is an isolated benzene ring and a heterocyclic ring fused to an alicyclic ring, then 3 rings are present; Bisphenol A contains 2 rings, Naphthalene contains 2 and Bisphenol K contains 7 (indexed as 5 or more).

Number of Atoms in Ring

These concepts are applied to a ring or ring system.

For example, ethylene oxide is a single individual ring with 3 atoms in the ring; naphthalene is a 10-membered ring system and phthalic anhydride is a 9-membered ring.

Atoms in Ring Systems

Atoms in ring systems are coded for each ring system present.

For example, Pyromellitic dianhydride is a fused ring system containing 3 rings with >1 O in the ring system:
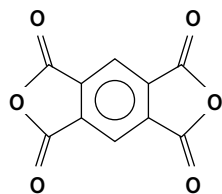
Benzophenone tetracarboxylic dianhydride contains 2 fused ring systems each containing 1 O.
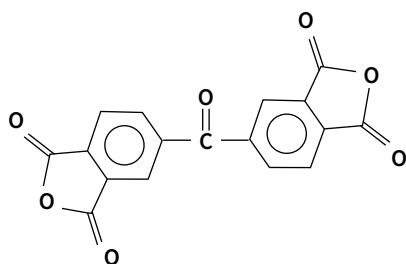
Carbon-Carbon unsaturation

Aromatic unsaturation is not included.

Terminal olefin unsaturation is defined as $X_2C=CH_2$ where X=monovalent atom/group.

Specific Functionality Terms

These are terms for functional groups. The largest specific group which defines the structure is used. Where a smaller structure is embedded within a larger one, the largest one defining the structure will be used. Thus in the case of guanidine, even though amidine is embedded within guanidine, only the term defining the largest specific group - in this case guanidine - will be used. For percarbonate, the use of peroxide as well as percarbonate does not add any more structural detail, and only the percarbonate aspect will be used. On the other hand, it is necessary to use quaternary nitrogen as well as azo for a diazonium ion. In this case azo defines the graph, while quaternary nitrogen adds further specificity.

If no single specific functionality term is suitable, then the structure will be defined by a combination of the largest applicable terms. Element terms are used to express any remaining parts of the structure. The element terms are not used for elements contained within the definition of the functionality - thus a disulphide would only receive the aspect Disulphide (F01).

The Acid derivative terms have been incorporated to cover classes of common condensants generically. They are especially useful for those polymers where it is not known which specific condensant has been used in the preparation, for example a polyester containing a terephthali- backbone which could have been derived from the dimethyl ester, the acid chloride etc.

Autoposting

There are two kinds of autoposting: upwards posting of broader terms, and 'cross posting' of chemical aspects.

Broader Terms

Any given term within a hierarchy will autopost to the corresponding broader term(s) within the hierarchy.

Thus, in the example on page 10, alpha-Methyl styrene, Halomethyl styrene, Cinnamic acid and Vinyl aromatic monoolefinic other will all autopost the code for Vinyl aromatics monoolefinic, which in turn will autopost Monoolefinic.

Each of the specific concepts within a hierarchy will autopost the appropriate wider generic term(s). These autoposted terms will be distinguishable from the terms which have actually been indexed. This is indicated with a role '-R' added to the code which has been indexed, not autoposted. Thus, Vinyl aromatics monoolefinic which has been indexed, rather than autoposted, would be G0102-R. This provides the option of searching for instances where the generic has been specifically indexed, to retrieve those patents which describe a concept only at the generic level. Comprehensive retrieval for a given concept can, therefore, be achieved by searching for the 'indexed' generic concept in addition to the specific concept, without the risk of retrieving records where the generic term has been autoposted by a different specific concept. A search for the generic without a role will retrieve references which have been specifically indexed together with those which have been autoposted.

Aspects

The chemical aspects are generated when SCNs are used, and the SCN and its aspects are tightly linked together. It is for this reason that the aspects have to be few in number, and the codes are as small as they can reasonably be - three characters each, or less in the case of element symbols. For the generic concepts some chemical aspects will be autogenerated, and more can be applied during indexing if the information is available.

Benefits of Autoposting

The versatility of this system allows for a compound such as alpha-Methyl styrene to be searched specifically by its SCN, generically via the Vinyl aromatics monoolefinic hierarchy and/or generically using chemical aspects; the chemical aspects in this case for alpha-Methyl styrene are:- organic, hydrocarbon, unsaturated aliphatic chain, benzene ring, 1 ring, 6- membered ring, monoolefinic, terminal olefin and 9 C. However, when using chemical aspects you must be aware that all compounds defined by a set of chemical aspects will be retrieved. For example, the aspects - aliphatic unsaturated chain, monoolefinic unsaturation, carbon count 2, halogen-carbon bond, Cl - will retrieve references to both vinyl chloride and vinylidene chloride, since both compounds are defined by the same set of Chemical Aspects.

Linking

The introduction of the many new concepts will obviously improve specificity, but more can be achieved if we can intelligently link information together. It is very important to be able to indicate associations between concepts in indexing, and to search these associations. This was the reason why the Key Serials were devised - they consist simply of ready-made combinations of the more fundamental concepts contained in the old punch code. In this system, we decided not to create more ready-made combinations of concepts, like the KS, but to use linking flexibly to indicate the associations between simple terms.

Three basic classes or levels of linking are being used:

- LEVEL 1   Linking chemical aspects to each other and to generic terms - essentially the complete description of a substance. At this level, certain special identifiers are also linked with the substance - the codes for Grafting monomer, Minor component and Macromer as monomer.

- LEVEL 2   Linking a substance with its function or use - as additive, catalyst component or polymer component. At this level the tight 'bundles' of coding defining substances are linked to codes for their function in the patent - usually codes from the polymer descriptors, catalysts or additives facets.

- LEVEL 3   Linking a substance, or a group of alternative substances, with another substance or group of alternative substances, such as an additive with a polymer.

These three levels of linking in the order given widen in scope - each is wider than its predecessor.

These three linking levels are contained within a linking group. A linking group is used to represent a polymer or family of polymers and all concepts related to that polymer or family. If there is more than one polymer family, for example - a bottle blow moulded from Polymer A and a cap for this bottle injection moulded from Polymer B containing pigment, then each polymer would be represented by a separate linking group within the same record. Each linking group would contain the data pertaining to the polymer, in the case of polymer B the identity of the pigment used. Concepts within one linking group can be searched with concepts in another linking group using the 'AND' operator.

A series of examples of gradually increasing complexity to illustrate the linking and the autoposting are given on the following pages. In appendix 2, there is a linking level table, which gives guidance on the linking levels to use between the codes from the various facets.

The first example of ABS containing a filler and calcium stearate lubricant, injection moulded to form automobile parts, represents a simplified view of the linking levels and the concepts to be linked. The smallest boxes, which are equivalent to the first level of linking, each contain a compound and all the information used to represent that compound (SCN or generic code and aspects).

These smallest boxes can be linked at the second level to their function. In the example, the polymer formers (monomers) are linked to each other and to the concepts for ternary copolymer, ABS and the relevant Polymer Types at this second level. Also at this level calcium stearate is linked to lubricant; if there were other compounds described as lubricants they too would be linked to lubricant in the same way. At the third level (the largest box), these classes of chemicals are linked together and linked to the concepts for injection moulding, ground vehicles and composition.

In the last example, we have expanded the contents of the boxes to show the autoposted terms and crossposted aspects.

Example 1

ABS with calcium stearate lubricant and a filler of carbon, talc or calcium carbonate for injection moulding of automobile parts
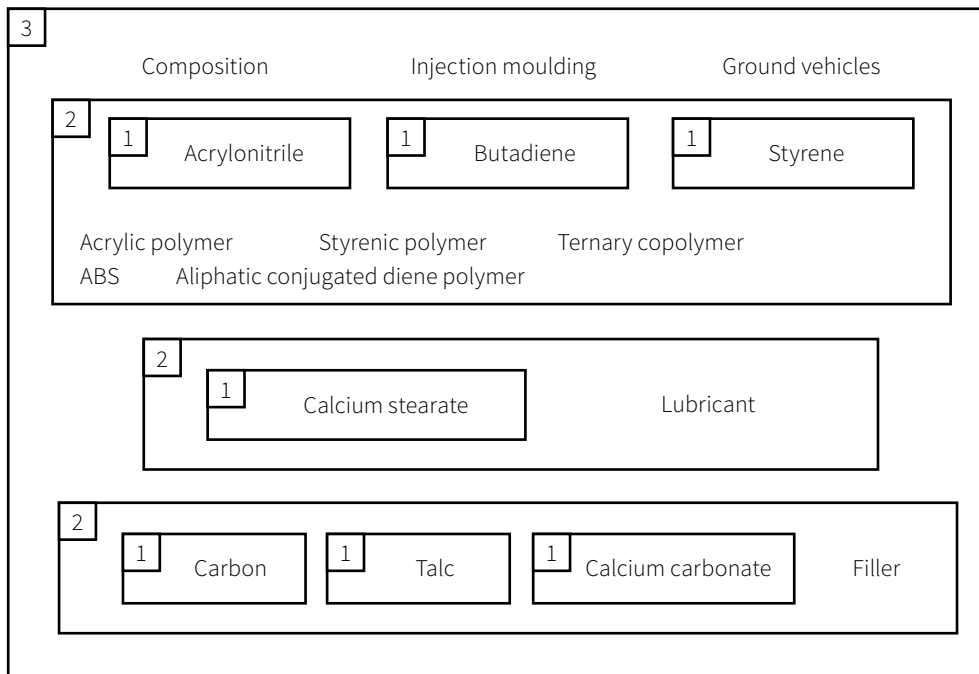
Example 2

Aqueous dispersion obtained by emulsion polymerisation of:

a) vinyl ester, preferably vinyl acetate and

b) acrylamide or methacrylamide, using H_2O_2 catalyst
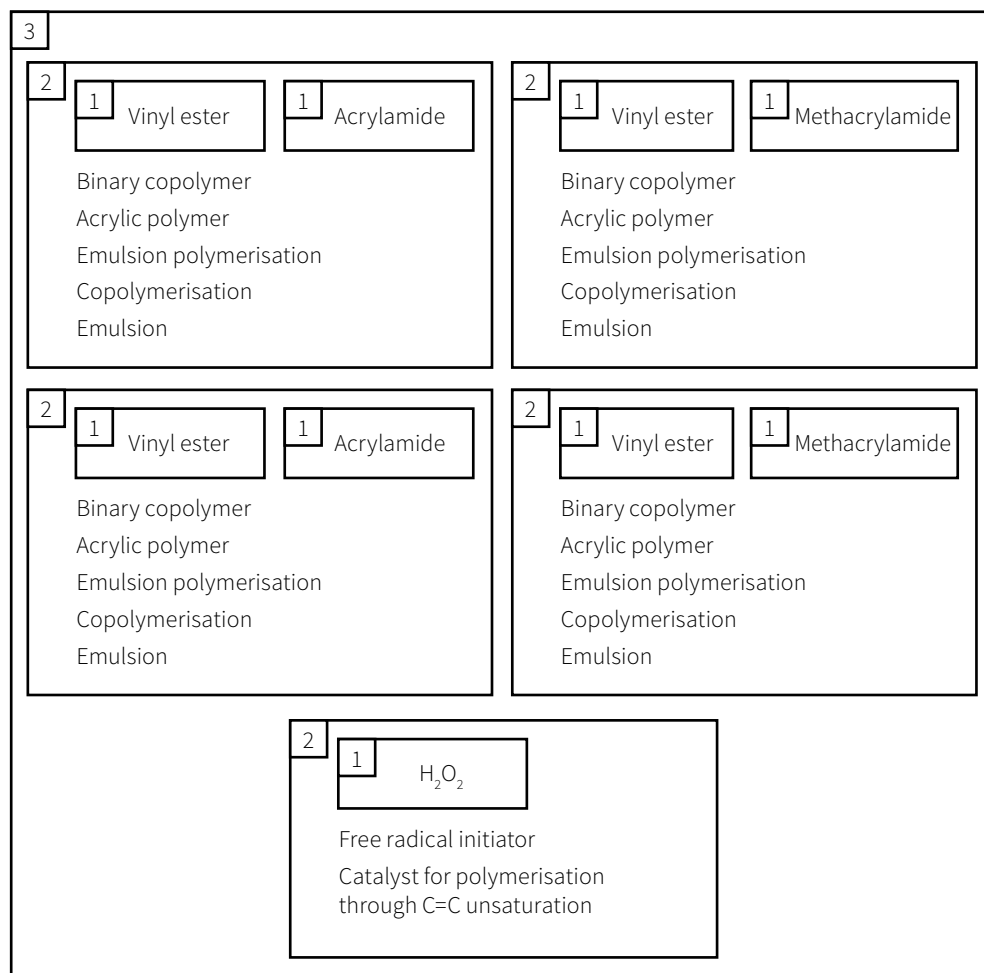
Example 3

Injection moulding composition containing Styrene
Butadiene copolymer grafted with Ethyl (meth)acrylate
and Potassium titanate whiskers as reinforcing agent

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┌─────────────────────────────────────────────────────────────────────────────┐
│ ┌3┐                                                                           │
│                                                                               │
│   ┌─────────────────────────────────────────────────────────────────────┐    │
│   ┌2┐                                                                     │    │
│   │  ┌1┐              ┌1┐               ┌1┐                          │    │
│   │  │    Styrene   │ │    Butadiene  │ │    Ethyl acrylate         │    │
│   │  └──────────────┘ └───────────────┘ │    Grafting polymer former│    │
│   │                                      └───────────────────────────┘    │
│   │  Styrenic polymer                                                      │    │
│   │  Graft copolymer          Aliphatic conjugated diene polymer          │    │
│   │  Acrylic polymer          Ternary copolymer                           │    │
│   └─────────────────────────────────────────────────────────────────────┘    │
│                                                                               │
│   ┌─────────────────────────────────────────────────────────────────────┐    │
│   ┌2┐                                                                     │    │
│   │  ┌1┐              ┌1┐               ┌1┐                          │    │
│   │  │    Styrene   │ │    Butadiene  │ │    Ethyl methacrylate      │    │
│   │  └──────────────┘ └───────────────┘ │    Grafting polymer former│    │
│   │                                      └───────────────────────────┘    │
│   │  Styrenic polymer                                                      │    │
│   │  Graft copolymer          Aliphatic conjugated diene polymer          │    │
│   │  Acrylic polymer          Ternary copolymer                           │    │
│   └─────────────────────────────────────────────────────────────────────┘    │
│                                                                               │
│   ┌───────────────────────────────────────┐     Reinforced                 │
│   ┌2┐                                      │                                │
│   │  ┌1┐                                   │     Injection moulding         │
│   │  │  Potassium titanate │   Whisker    │                                │
│   │  └─────────────────────┘              │                                │
│   │  Reinforcing agent                    │                                │
│   └───────────────────────────────────────┘                                │
│                                                                               │
└─────────────────────────────────────────────────────────────────────────────┘
```

Example 4

Multi-ply film for packaging has 3-ply structure:

- Surface layer - EPDM, where diene monomer is cyclopentadiene

- Middle adhesive layer - Ethylene-Vinyl acetate

- Base layer - Ethylene Propylene random
  copolymer produced by coextrusion

```
┌─────────────────────────────────────────────────────────────────────┐
│ 3                                                                     │
│                                                                       │
│            Packaging                   Polymeric exterior layer       │
│                                                                       │
│      Tri-layer structure          Coextruding          Polymer interface │
│                                                                       │
│   ┌─────────────────────────────────────────────────────────────┐   │
│   │ 2                                                            │   │
│   │   ┌────────────────┐      ┌────────────────┐                │   │
│   │   │ 1   Ethylene   │      │ 1 Cyclopentadiene│  Polyolefin   │   │
│   │   └────────────────┘      └────────────────┘                │   │
│   │                                           Film      EPDM     │   │
│   │   ┌────────────────┐                                        │   │
│   │   │ 1   Propylene  │      Ternary copolymer    Elastomer     │   │
│   │   └────────────────┘                                        │   │
│   └─────────────────────────────────────────────────────────────┘   │
└─────────────────────────────────────────────────────────────────────┘
```

```
┌─────────────────────────────────────────────────────────────────────┐
│ 3                                                                     │
│                                                                       │
│         Packaging                Adhesiveness          Polymer interface │
│                                                                       │
│      Tri-layer structure          Coextruding             Tie layer   │
│                                                                       │
│   ┌─────────────────────────────────────────────────────────────┐   │
│   │ 2                                                            │   │
│   │   ┌────────────────┐      ┌────────────────┐                │   │
│   │   │ 1   Ethylene   │      │ 1  Vinyl acetate│                │   │
│   │   └────────────────┘      └────────────────┘                │   │
│   │   Binary copolymer       Polyolefin        Film             │   │
│   │   Ethylene - Vinyl acetate BCP                              │   │
│   └─────────────────────────────────────────────────────────────┘   │
└─────────────────────────────────────────────────────────────────────┘
```

```
┌─────────────────────────────────────────────────────────────────────┐
│ 3                                                                     │
│                                                                       │
│           Packaging                        Polymer interface          │
│                                                                       │
│        Tri-layer structure                   Coextruding              │
│                                                                       │
│   ┌─────────────────────────────────────────────────────────────┐   │
│   │ 2                                                            │   │
│   │   ┌────────────────┐      ┌────────────────┐                │   │
│   │   │ 1   Ethylene   │      │ 1   Propylene  │                │   │
│   │   └────────────────┘      └────────────────┘                │   │
│   │   Binary copolymer       Random copolymer      Polyolefin    │   │
│   │   Ethylene - propylene BCP    Film                          │   │
│   └─────────────────────────────────────────────────────────────┘   │
└─────────────────────────────────────────────────────────────────────┘
```
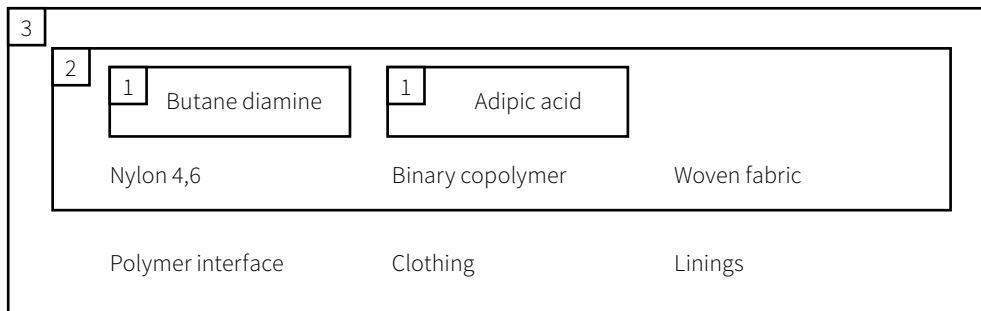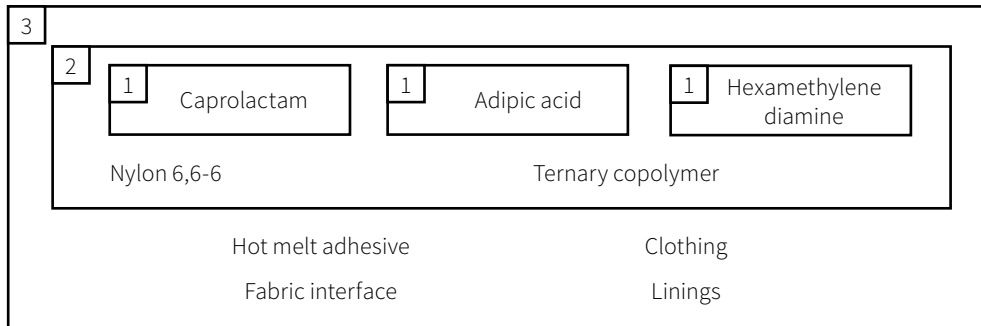
Example 5

Epoxy resin composition for sealing semiconductor devices
comprising Bisphenol A-epoxy resin, dicyandiamide
crosslinker, inorganic filler, aminopropyltriethoxy
silane, tetrabromobisphenol A (flame retardant), and
antimony trioxide (assistant flame retardant)

```
3
    2
        1   Bisphenol A          1   Epihalohydrin      Encapsulated article

        Binary copolymer         Bisphenol A            Semiconductor devices
                                 Epoxy resin

    2                                2
        1   Dicyandiamide            1   Inorganic

        Crosslinking agent           Filler

    2
        1   Aminopropyltriethoxy silane

        Adhesion improver

    2                                2
        1   Tetrabromobisphenol A    1   Antimony trioxide

        Flame retardant              Flame retardant
```
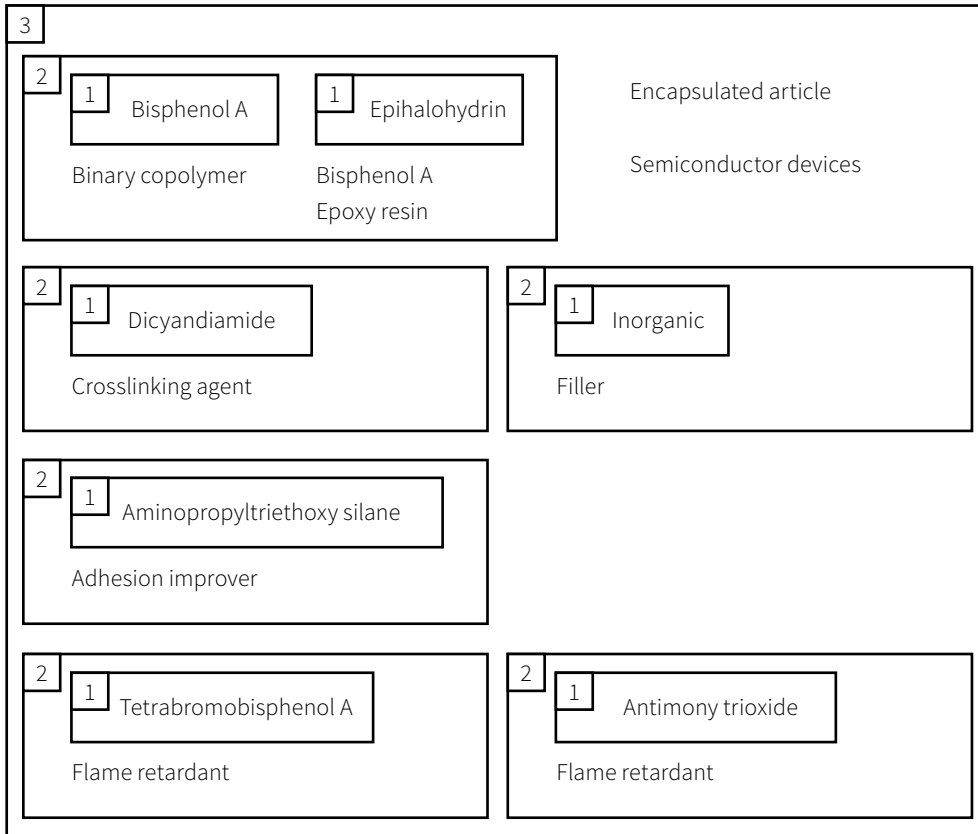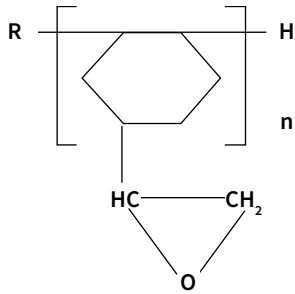
Example 6

Hot melt adhesive containing copolyamide from
caprolactam, hexamethylene diamine and adipic
acid coated on nylon 4,6 fabric from butane diamine
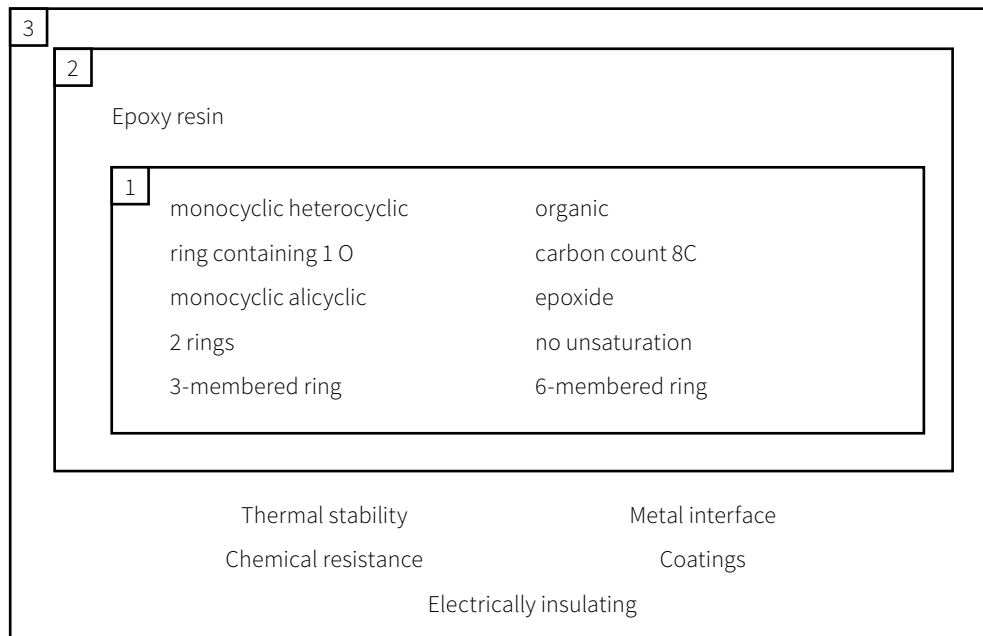and adipic acid for use as garment interlinings.

3			
	2		
	1 Caprolactam	1 Adipic acid	1 Hexamethylene diamine
	Nylon 6,6-6	Ternary copolymer	
	Hot melt adhesive	Clothing	
	Fabric interface	Linings	

3			
	2		
	1 Butane diamine	1 Adipic acid	
	Nylon 4,6	Binary copolymer	Woven fabric
	Polymer interface	Clothing	Linings

Example 7

Alicyclic epoxy resin of the following formula:

where R = hydrocarbon
n = 2-30

having good heat resistance, chemical resistance and
electrical insulation was coated on copper foil.

<table>
<tr><td colspan="2">3</td></tr>
<tr><td colspan="2">2   Epoxy resin</td></tr>
<tr><td colspan="2">1</td></tr>
<tr><td>monocyclic heterocyclic</td><td>organic</td></tr>
<tr><td>ring containing 1 O</td><td>carbon count 8C</td></tr>
<tr><td>monocyclic alicyclic</td><td>epoxide</td></tr>
<tr><td>2 rings</td><td>no unsaturation</td></tr>
<tr><td>3-membered ring</td><td>6-membered ring</td></tr>
<tr><td>Thermal stability</td><td>Metal interface</td></tr>
<tr><td>Chemical resistance</td><td>Coatings</td></tr>
<tr><td colspan="2">Electrically insulating</td></tr>
</table>

Example 8

Paint composition for metal surfaces containing styrene
divinyl benzene with a titanium oxide pigment

```
┌─3─────────────────────────────────────────────────────────────────┐
│ ┌─2───────────────────────────────────────────────────────────┐   │
│ │ ┌─1─────────────────────────────────────────────────────┐   │   │
│ │ │   G0022     Monoolefinic                               │   │   │
│ │ │               ↑                                        │   │   │
│ │ │   G0102     Vinyl aromatics monoolefinic               │   │   │
│ │ │               ↑                                        │   │   │
│ │ │   R00708   Styrene ──────→ D01 D02 D12 D19 D31 D53 D58 D76 D88 │
│ │ └────────────────────────────────────────────────────────┘   │   │
│ │ ┌─1─────────────────────────────────────────────────────┐   │   │
│ │ │   G0817     Diolefinic                                 │   │   │
│ │ │               ↑                                        │   │   │
│ │ │   G0840     Aromatic hydrocarbons diolefinic           │   │   │
│ │ │               ↑                                        │   │   │
│ │ │   G0851    Divinylbenzenes ──→ D01 D02 D12 D19 D31 D54 D58 D76 D90 │
│ │ └────────────────────────────────────────────────────────┘   │   │
│ │   H0011    Copolymer              P1741     Styrenic polymers  │   │
│ │             ↑                                  ↑               │   │
│ │   H0022   Binary copolymer        P1774    Styrene - Divinyl benzene BCP │
│ └───────────────────────────────────────────────────────────────┘ │
│ ┌─2───────────────────────────────────────────────────────────┐   │
│ │ ┌─1─────────────────────────────────────────────────────┐   │   │
│ │ │   R01966   Titanium oxide ──────→ D00 F20 Ti O- Tr     │   │   │
│ │ └────────────────────────────────────────────────────────┘   │   │
│ │   A077     Colouring agent                                    │   │
│ │             ↑                                                 │   │
│ │   A102    Pigment                                            │   │
│ └───────────────────────────────────────────────────────────────┘ │
│   Q7114    Coatings              K9483     Interface               │
│             ↑                                ↑                     │
│   Q7158   Paints                 K9552    Metal interface         │
└────────────────────────────────────────────────────────────────────┘
```

Key:

R00708 Styrene   - specifically indexed terms

G0022   Monoolefinic   - autoposted generic terms

D01 -   - autoposted chemical aspect codes

Documentation

- Polymer Indexing Hierarchy

- Polymer Indexing Thesaurus

- Polymer Indexing Reference Manual

- Polymer Indexing System Description

Several indicators are used in these manuals to show relationships. These are: NT, BT, SA, SEE, UF and USE.

The indicators and the nature of the terms that they relate are shown in the following table:

NT = "Narrower Term"	the expression following this is a narrower term encompassed within the term listed above the "NT".
BT = "Broader Term"	the expression following this is a broader term which encompasses the term(s) listed above the "BT".
SA = "See Also"	this directs the user to other primary terms which may be relevant to the area of their search. There is no BT/NT relationship with these other terms, they are simply logically related.
SEE	there is no term as such in the system for the term listed; instead, you should try the terms which follow the word "SEE". These terms will not necessarily be synonymous; they are simply the closest concepts in the system that are available.
UF = "Used For"	the term which follows is not searchable as such, and you should search instead using the term listed above the "UF".
USE	the term listed is a primary term which should be used instead of the synonym.

NT and BT are converses, and so are "UF" and "USE". SEE and SA are not converses since each of them can imply a "one with many" relationship.

Scope Notes are given in quotation marks immediately below the term they refer to. They are present to explain the use and scope of the terms.

Polymer Indexing Hierarchy

The Hierarchy provides a hierarchical list of all the concepts facet by facet. The relationships between the concepts are shown, and codes for all the primary terms are given. The extracts below illustrate the format of the hierarchy.

N6611	Process control	
N6622	NT	Automation
	UF	Computer control
N6633	NT	Temperature control
	SA	pH control
N6644	Purging	
	UF	Flushing

Extract from Physical Operations facet, Polymer Indexing Hierarchy

R05085	Carbon black	
	UF	Acetylene black
	UF	Activated charcoal
	SA	Carbon
	SA	Graphite
G2675	Chromium chlorides (gen)	
	"Used when no specific chromium chloride given"	
R10690	NT	Chromium(II) chloride
R01883	NT	Chromium(III) chloride

Extract from Chemicals facet, Polymer Indexing Hierarchy

Polymer Indexing Thesaurus

The main function of the Thesaurus is to enable the user to navigate through the maze of terms and relationships. Primary terms each have an entry in bold type in the Thesaurus; secondary terms are listed in bold type enclosed in curly brackets. All relationships are listed under the concept, but only one level of narrower terms is indicated.

G0260	**Acrylics monoolefinic**	*[polymer formers]*
	NT	Acrylic acids monoolefinic
	NT	Acrylic esters monoolefinic
	NT	Acrylic amides monoolefinic
	NT	Acrylic nitriles monoolefinic
	NT	Acrylic aldehydes monoolefinic
	NT	Acrylic acid halides monoolefinic
	NT	Acrylic monoolefinic, other
	BT	Monoolefinic

Extract from Polymer Indexing Thesaurus

A113	**Compatibility improver**	*[additives]*
K9756	**Compatible polymer blend**	*[universal terms]*
	NT	Interpenetrating polymer network
	BT	Polymer blend
A124	**Complexing agent**	*[additives]*
	UF	Chelating agent
	UF	Sequestering agent
	{Compliance}	*[properties]*
	USE	Rigidity properties B3930

Extract from Polymer Indexing Thesaurus

Polymer Indexing Reference Manual

The reference manual consists of three parts.

I. The Polymer Indexing Code List

The Code List is an alpha-numeric list of all the polymer indexing codes with their concepts; it also contains all the autoposted terms for each code.

L2835	Chemical process, other	
	L9999 L2835	
L9999	Chemical Processes facet	
La	Lanthanum	
	La 9A Tr	
Li	Lithium	
	Li 1A	
Lu	Lutetium	
	Lu 9A Tr	
Lw	Lawrencium	
	Lw 9B Tr	
M2006	Acetalised polymer	
	M9999 M2006	

Extract from Polymer Indexing Reference Manual - Code List

II. The Polymer Indexing Molecular Formula List

The Molecular Formula List contains the molecular formulae for all the Specific Compound Numbers in the Polymer Index which have a known structure. Elements in each molecular formula are listed according to the Hill convention (C, H, other elements in alphabetical order).

Cl_6H_2Pt	R01998	Chloroplatinic acid
Cl_6W	R06087	Tungsten hexachloride
CrO_4Pb	R05237	Lead(II) chromate
Cr_2O_3	R01933	Chromium(III) oxide
Cu	R05099	Copper
Cu_2O	R03269	Copper(I) oxide
FK	R01815	Potassium fluoride
Fe	R03036	Iron

Extract from Polymer Indexing Reference Manual – Molecular Formula List

III. The Polymer Indexing Chemical Aspects - Graphical Definitions

The Chemical Aspects Definitions contain the chemical aspects with graphical representations.

F47　Epoxide, oxirane

F68　Thiourea
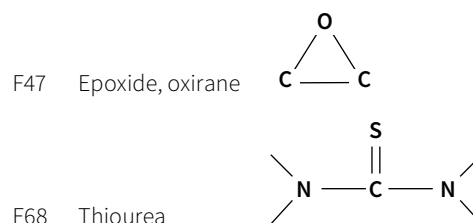
Extract from Polymer Indexing Reference Manual - Chemical Aspects, Graphical Definitions

Searching

The simplest way to create a search query is to begin with the compound(s) of interest and then build up the search from the 1st level of linking out to the 3rd level.

First define the substance(s) of interest, and for each one create a search statement comprising the SCN(s) and/or generic terms and aspects linked at level 1.

Next, take each search set for a substance or group of alternative substances, and link these at level 2 with their function.

Finally search all the sets obtained in step 2, linked together at level 3, optionally including codes for polymer applications, properties etc.

Each of the hosts have used different operators to define the linking levels, as indicated below:

Linking Levels	Derwent Innovation	Questel English	Questel French	STN
1 (tightest) level	S	(PHR)	(S)
2 (middle) level	P or L	(LIE)/(PRG)	(P)
3 (widest) level	F	(CHP)	(L)

In the following explanation we will use:-

(1) to indicate linking at level 1,

(2) to indicate linking at level 2 and

(3) to indicate linking at level 3

If you do not have any compounds in your search, it is not necessary to use the first level of linking. You do not have to use all the levels of linking. In fact, searching can be carried out without using linking at all, although the specificity may suffer as a result.

Searching compound(s)

The 1st LEVEL LINKING is used to search for a compound chemically.

Specific Compound Numbers (SCN) are used to define polymer formers, natural polymers, modifying agents, additives and catalysts.

Generic codes (Gnnnn), optionally in combination with Chemical Aspects, are used for polymer formers, natural polymers and some additives and catalysts.

Chemical Aspects are used to define polymer formers, polymer types, natural polymers, modifying agents, additives and catalysts.

Specific compounds with SCN

We will begin by looking at how to search for a few simple compounds.

Compounds with a Specific Compound Number can be fully defined by searching the SCN. Thus:

Ethylene - R00326

Carboxymethyl cellulose - R01835

Maleic anhydride - R00843

Calcium carbonate - R01278

Triethyl aluminium - R00659

When these SCNs are indexed, they additionally autogenerate the Chemical Aspects for the specific compound.

Specific compounds without SCN

Compounds which do not have a SCN can be defined in terms of Chemical Aspects. For polymer formers a Generic code or 'Others' code (Gnnnn) is used with the aspects. All these terms should be linked using the first level of linking.

4-Chlorophenol

D19 (1) D31 (1) D50 (1) D69 (1) D86 (1) F31 (1) Cl

where the aspects used are as follows:

D19   Benzene ring

D31   1 ring

D50   No unsaturation

D69   Halogen–C

D86   6 Carbons

F31   Monophenol

Cl   Chlorine

This will retrieve all references to compounds defined by this set of aspects, i.e. polymer formers, additives, catalysts, polymer types and modifying agents. If we wish to restrict the search to polymer formers only, we can add to the search the code for Monohydric phenol, other (G1138).

4-Chlorophenol as Polymer Former

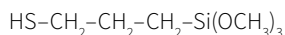D19 (1) D31 (1) D50 (1) D69 (1) D86 (1) F31 (1) Cl (1) G1138

The following examples will retrieve all references to compounds defined by the linked set of aspects:

Aluminium chloride

D00 (1) Al (1) Cl

where the aspects are as follows:

D00   Inorganic

Al   Aluminium
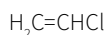
Cl   Chlorine

Mercaptopropyl trimethoxysilane

$HS-CH_2-CH_2-CH_2-Si(OCH_3)_3$

D11 (1) D50 (1) D86 (1) F04 (1) F86 (1) F87

where the aspects are:

D11	Aliphatic saturated chain
D50	No unsaturation
D86	6 Carbons
F04	Thiol
F86	Si-Hydrocarbyl
F87	Si-O-Hydrocarbyl

Vinyl chloride

To illustrate that searching using aspects only will retrieve all references to compounds defined by the set of aspects, we can search for vinyl chloride using only aspects:

$H_2C=CHCl$

(1) D53 (1) D58 (1) D69 (1) D82 (1) Cl

D12	Unsaturated aliphatic chain
D53	Monoolefinic
D58	Terminal olefin
D69	Halogen-C
D82	2 Carbons
Cl	Chlorine

Apart from references to vinyl chloride, these aspects will also retrieve references to vinylidene chloride and any other compound which can be defined by these aspects.

In the following examples, we have restricted the search to polymer formers, by including an 'Others' code i.e. Gnnnn in the search statement.

Hydroxyalkyl vinyl ether

$CH_2=CH-O-(CH)_nOH$
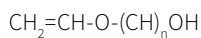
G0599 (1) D11 (1) D12 (1) D53 (1) D58 (1) F27 (1) F34

where the codes are as follows:

G0599	Vinyl ether, other
D11	Saturated aliphatic chain
D12	Unsaturated aliphatic chain
D53	Monoolefinic
D58	Terminal olefin
F27	Monohydroxy
F34	Ether

Octadecyl acrylate

$CH_2=CH-CO_2-C1_8H_37$
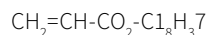
G0373 (1) D11 (1) D12 (1) D53 (1) D58 (1) D94 (1) F41

where the codes are as follows:

G0373	Acrylic acid ester monoolefinic, other
D11	Saturated aliphatic chain
D12	Unsaturated aliphatic chain
D53	Monoolefinic
D58	Terminal olefin
D94	Carbon count 19C-24C
F41	Carboxylic ester

Generic compounds

Generic searching can be carried out using 'Gnnnn' codes, aspects or a combination of both, all linked together at level 1.

Fluorine containing diolefinic esters

F- (1) D54 (1) D63 (1) D69

In this case the aspects are:

F-	Fluorine
D54	Diolefinic
D63	Ester
D69	Halogen-C

We can link the generic code for Diolefinic polymer formers (G0817) to the above aspects at level 1. This would limit the search to polymer formers.

Diamino diphenyl alkanes

D11 (1) D19 (1) D32 (1) D50 (1) D76 (1) F09

In this case the aspects are:

D11	Saturated aliphatic chain
D19	Benzene ring
D32	2 rings
D50	No unsaturation
D76	6-member ring
F09	Diamine

This search could be limited to polymer formers by the inclusion of the generic term Diamine polymer formers (G1672), again linked at level 1 to the aspects.

All of these methods of searching for compounds can then be linked with specific functions as we will explain on the following page.

Searching Polymers

The traditional indexing policy has been retained – polymers are coded in terms of the polymer formers wherever possible in addition to polymer types. Where the polymer former(s) are not known, then polymer types and/or aspects only are used for indexing.

- **Polyethylene** would be indexed as both Ethylene plus Homopolymer and Polyethylene and could thus be searched either via the polymer former or the polymer type.

- **Polyurethane from a diisocyanate** would be indexed only using the polymer type code for

- **Polyurethane** and the polymer former code for Diisocyanate.

- **Polyamide** with no further information would be indexed only as Polyamide (polymer type).

- **Aromatic polyethersulphone** would be indexed as Polyethersulphone plus the chemical aspect for Aromatic.

Searching compound(s) with function(s)

The 2nd LEVEL LINKING is used to define the function(s) of a compound or combination of compounds.

Examples of functions which can be linked with compounds are:- homopolymer, binary copolymer, graft copolymer, oligomer, prepolymer, polymer former, modifying agent, all the additive functions such as filler, light stabiliser, dye, tackifier etc. and all the catalyst functions such as catalyst support, Redox catalyst, electron donor etc.

Specific compound(s) with functions

Compound(s) can be searched with one or more function(s) linked at 2nd level of linking.

Thus, by taking some of the examples from above we can build up our search query by combining a function at the 2nd level of linking.

Ethylene homopolymer

R00326 (2) H0000

where R00326 is Ethylene, H0000 is Homopolymer.

Maleic anhydride modifying agent

R00843 (2) H0226

where R00843 is Maleic anhydride, H0226 is Modifying agent.

Calcium carbonate filler

R01278 (2) A237

where R01278 is Calcium carbonate, A237 is Filler.

Triethyl aluminium activator

R00659 (2) C124

where R00659 is Triethyl aluminium, C124 is Cocatalyst (UF activator)

2,3,6-Trimethyl phenol stabiliser

[D11 (1) D19 (1) D31 (1) D50 (1) D89 (1) F31] (2) A486]

where D11 is Aliphatic saturated chain, D19 is Benzene ring, D31 is 1 ring, D50 is No unsaturation, D89 is 9 carbons, F31 is Monophenol, A486 is Stabiliser .

Copolymers

A copolymer can be searched by combining the polymer formers with the appropriate copolymer term and linking these terms together at level 2.

Isobutylene - Maleic anhydride binary copolymer

R00966 (2) R00843 (2) H0022

where R00966 is Isobutylene, R00843 is Maleic anhydride and H0022 is Binary copolymer.

Bisphenol F - Epichlorohydrin Epoxy resin

R12487 (2) R00798 (2) H0022 (2) P0464

where R12487 is Bisphenol F, R00798 is Epichlorohydrin, H0022 is Binary copolymer, and P1901 is Biphenol F type Epoxy resin.

Acrylonitrile - Butadiene - Styrene ternary copolymer

R00817 (2) R00806 (2) R00708 (2) H0033

where R00817 is Acrylonitrile, R00806 is Butadiene, R00708 is Styrene and H0033 is Ternary or higher copolymer.

Alternatively acrylonitrile-butadiene-styrene ternary copolymer could be searched using the Polymer type code for ABS (P0191). There should be no difference in the results obtained from using the polymer formers or the polymer types.

Compound(s) with more than one function

More than one function may be linked to a compound or combination of compounds at level 2.

Acrylonitrile - Butadiene - Styrene Graft ternary copolymer

R00817 (2) R00806 (2) R00708 (2) H0033 (2) H0088

where R00817 is Acrylonitrile, R00806 is Butadiene, R00708 is Styrene, H0033 is Ternary or higher copolymer and H0088 is Graft copolymer.

PTFE as a lubricant additive for a polymer

R00975 (2) H0000 (2) A340 (1) A782

where R00975 is Tetrafluoroethylene, H0000 is Homopolymer, A340 is Lubricant additive and A782 is Polymeric additive.

Searching combinations of compounds with non-structural concepts

The 3rd LEVEL LINKING is used to combine compounds with their properties, applications etc. and also with other compounds. Examples would include polymer with moulding process and application, polymer with additives and/or catalysts as shown below.

Examples

1. **Container formed by blow moulding polyester**

Polyester - P0839

Blow moulding - N6451

Container - Q8399

P0839 (3) N6451 (3) Q8399

2. **Glass fibre reinforced automobile bumpers**

Glass fibre - G2891

Reinforcing Agent - A419

Vehicle parts - Q9289

Ground vehicles - Q9234

S1 G2891 (2) A419

S2 S1 (3) Q9234 (3) Q9289

3. **Epoxy resin with phenolic crosslinking agent**

Epoxy resin - P0464

Phenolic - F30

Crosslinking agent - A157

S1 F30 (2) A157

S2 P0464 (3) S1

Further Examples

Using "-R"

"-R" is added to those codes which have been actually indexed, rather than autoposted. The codes can be searched with "-R", to retrieve only those records where the code was actually indexed, or without "-R" to retrieve the autoposted references as well.

If we were searching for ethylene and were also interested in the generic (cyclo)aliphatic monoolefinic hydrocarbon terms which had been indexed, but not those generic terms which had been autoposted from other specifics, we would use G0033-R.

This search is illustrated below:

> (R00326 OR G0033-R)
>
> where R00326 is ethylene and G0033-R is (Cyclo) aliphatic monoolefinic hydrocarbons

Likewise with the non-structural codes we could search for Electrical properties B3190-R. This would only retrieve references to electrical properties which had been indexed, and not those cases where the code had been autoposted from more specific terms.

Modifying agents

Modifying agents can be searched using either SCN or chemical aspects. The compound should be linked to the term for modifying agent at level 2.

For example, Epoxy resins (P0464) modified with Acrylic acid (R00446), where H0226 is modifying agent should be searched as follows:

S1	R00446 (2) H0226
S2	P0464
S3	S1 (3) S2

Another example would be a search for Propylene (R00964) polymer graft modified by Maleic anhydride (R00843). In this case the graft modified could be interpreted as either graft copolymerised or modified and the following search takes both options into account, (where H0226 is Modifying agent, H0000 is Homopolymer and H0088 is Graft copolymer).

S1	R00843 (2) (H0226 OR H0088)
S2	R00964 (2) (H0000 OR H0088)
S3	S1 (3) S2

Special Polymer Descriptor codes

There are three Polymer Descriptor codes (Hnnnn) codes, which should be linked at level 1, in order to achieve maximum specificity. These three are listed and exemplified below.

> Minor component
>
> Grafting polymer former
>
> Macromer as polymer former

Minor component

The Minor component term (H0215) is only applied to components of a copolymer and then only when the maximum percentage of a polymer former within a copolymer is no greater than 10%.

Thus an Ethylene copolymer (R00326) containing 1-5% Propylene (R00964), could be searched as follows:

S1	R00964 (1) H0215
S2	R00326 (2) H0022
S3	S1 (2) S2

where H0215 is Minor component and H0022 is Binary copolymer

Grafting polymer former

The Grafting polymer former term (H0146) should be linked at level 1 to the compound functioning as the grafting polymer former.

Thus grafting of Acrylonitrile (R00817) onto a Butadiene (R00806) Styrene (R00708) copolymer would be searched as follows:

|	
S1	R00817 (1) H0146
S2	S1 (2) R00806 (2) R00708 (2) H0033 (2) H0088

where H0146 is Grafting polymer former, H0033 is Ternary or higher copolymer and H0088 is Graft copolymer

Macromer as polymer former

There are two concepts for searching macromers - one being Macromer as polymer former (H0204) and the other being Macromer as modified polymer (H0191). The use of these two concepts is probably best explained by considering a simple example.

A copolymer of methyl methacrylate and an acrylated polyethylene oxide of the following formula

$$CH_2=CH-COO(CH_2CH_2O)_{20}H$$
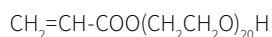
can be searched as a copolymer of the polymer formers i.e. methyl methacrylate and the specified acrylate ester. In this case, the Macromer as polymer former term (H0204) is linked at level 1 to the Other acrylate ester code used for the acrylate ester. In this search we are considering the acrylated polyethylene oxide as an acrylate monomer using the Macromer as polymer former term.

The search for the polymer former $CH_2=CH-COO(CH_2CH_2O)_{20}H$ would be structured as follows where (1) indicates linking at level 1 (in this example we have shown all possible aspects, although it is unlikely that one would search for them all).

> G0373 (1) D01 (1) D11 (1) D26 (1) D53 (1) D58 (1)
> D63 (1) D95 (1) F27 (1) F34 (1) F41(1) H0204

G0373	Other acrylic acid ester
D01	Organic
D11	Saturated aliphatic chain
D26	Acyclic
D53	Monoolefinic
D58	Terminal olefin
D63	Ester
D95	≥25 Carbons
F27	Monohydroxy
F34	Ether
F41	Carboxylic ester
H0204	Macromer as polymer former

The results of this search should then be linked at level 2 with the codes for Methyl methacrylate and Binary copolymer.

In a separate linking group, this acrylated polyethylene oxide can be regarded as a modified polyether and searched with the term H0191 Macromer as modified polymer. We will cover this below.

Macromer as Modified Polymer

Continuing on, we will consider the same example but searching for the acrylated polyethylene oxide as a modified polyether, rather than an acrylic acid ester.

$$CH_2=CH-COO(CH_2CH_2O)_{20}H$$
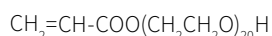
The search would be:

> R00351 (2) H0000 (2) H0191 (2) P8004 (2) M0217 (2) M2153

R00351	Ethylene oxide
H0000	Homopolymer
H0191	Macromer as modified polymer
P8004	Polyethylene glycol
M0217	Acrylated
M2153	End group modified

Searching using Polymer types and Polymer formers

For the reaction product of bisphenol ketone and dichlorodiphenyl sulphone, we can search for a copolymer of the polymer formers, (where G1194 is bisphenol ketones, R00471 is dichlorodiphenyl sulphone and H0022 is binary copolymer).

> G1194 (2) R00471 (2) H0022

However, a structure of the following formula may have been derived from the same two polymer formers, and should, therefore, be searched in addition.
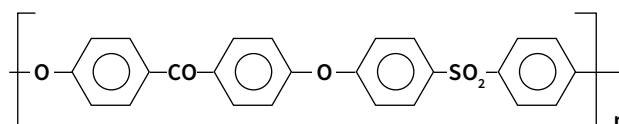
> P0964 (2) F23 (2) F61 (2) H0293

To ensure complete retrieval of all references to the above structure, regardless of polymer formers, the following strategy should be used:

> (Polyether or ether) (2) (Polyketone or ketone) (2) (Polysulphone or sulphonyl)

> (P0964 OR F34) (2) (P1149 OR F23) (2) (P1490 OR F61) (2) D19 (2) D34

F23	Ketone
F34	Ether
F61	Sulphonyl
H0293	Ring in backbone of polymer
P0964	Polyether
P1149	Polyketone
P1490	Polysulphone
D19	Benzene ring
D34	4 Rings

Worked examples on Questel

The following operators are used on Questel:

boolean	and, or, not	et, ou, sans
3rd (widest) level of linking	F	(CHP)
2nd (middle) level of linking	P or L	(LIE)/(PRG)
1st (tightest) level of linking	S	(PHR)

Molybdenum Catalyst

C000   Catalyst

Mo   Molybdenum

?/PI Mo (L) C000

** SS 1: Results 969

AN -   2000-559637 [52]

TI -   Catalyst for producing partially oxidized organic compounds comprises an inert carrier and an active component which includes molybdenum and vanadium

PI01 - [001] 018; R00446 G0282 G0271 G0260 G0022 D01 D12 D10 D26 D51 D53 D58 D60 D83 F36 F35; H0271; L9999 L2471; L9999 L2437-R; L9999 L2062

- [002] 018; R00517 G1401 G1398 G4024 D01 D24 D22 D32 D42 D50 D65 D77 D88 F39 E00 E19; R00843 G0760 G0022 D01 D23 D22 D31 D42 D51 D53 D59 D65 D75 D84 F39 E00 E01; R00556 G1423 G1398 G4024 D01 D07 D25 D22 D33 D46 D50 D65 D78 D90 F39 E30 E32; H0271; L9999 L2471; L9999 L2437-R; L9999 L2084; L9999 L2835

- [003] 018; ND02

- [004] 018; D00 F20 Mg 2A Ca Sr Ba Sn 4A P- 5A Sb Bi O- 6A Te Ti 4B Tr Zr V- 5B Nb Cr 6B Mo W- Mn 7B Co 8B Ni Cu 1B Zn 2B Ce 9A; C999 C102 C000; C999 C259; C999 C248

- [005] 018; G3190 R01541 D00 F80 O- 6A Mg 2A Si 4A; R01247 D00 C- 4A Si; R01949 D00 F80 O- 6A Al 3A Si 4A; C999 C168; C999 C259; S9999 S1456-R; B9999 B5209 B5185 B4740

- [006] 018; D00 F16 H- N- 5A O- 6A V- 5B Tr; R06252 D00 F16 HN- 5A O- 6A Mo 6B Tr; D00 F16 H- N- 5A O- 6A W- 6B Tr; C999 C102 C000; C999 C157; C999 C259

Polyesteramide ordered cocondensate

P0760   Polyesteramide

H0044   Block copolymer

?/PI P0760 (LIE) H0044

** Question 1, nombre de reponses 198

AN -   2000-465295 [40]

TI -   Isocyanate based polymer foam, for molded or slab stock foams, includes particulate material with specific phase transition enthalpy

PI01 - [001] 018; G1934 G1854 G1843 D01 F73 D11 D10 D50 D86; R01455 G1854 G1843 D01 D11 D10 D50 D88 F73; R01392 G1912 G1854 G1843 D01 D11 D10 D19 D18 D31 D50 D76 D89 F73; R00574 G1912 G1854 G1843 D01 D11 D10 D19 D18 D31 D50 D76 D89 F73; R20015 G1887 G1854 G1843 D01 D11 D10 D19 D18 D32 D50 D76 D93 F73; R00735 G1887 G1854 G1843 D01 D11 D10 D19 D18 D32 D50 D76 D93 F73; R12045 G1901 G1854 G1843 D01 D20 D18 D32 D50 D78 D92 F73; R24058 G1945 G1843 D01 D11 D10 D19 D18 D50 F73; R01295 G2131 D01 D23 D22 D31 D42 D50 D77 D86 F43; G1934 G1854 G1843 D01 F73 D11 D10 D23 D22 D31 D75 D42 D54 D51 D56 D59 D87 F34; G1934 G1854 G1843 D01 F73 D11 D10 D19 D18 D32 D76 D50 D93; G1934 G1854 G1843 D01 F73 D11 D10 D19 D18 D31 D76 D50 D69 D89 Cl 7A; G1934 G1854 G1843 D01 F73 D23 D22 D31 D76 D45 D50 D85 F19; G1934 G1854 G1843 D01 F73 D11 D10 D14 D13 D31 D76 D50 D89; G1876 G1854 G1843 D01 D19 D18 D31 D50 D76 D88 F73; G1901-R G1854 G1843 D01 D20 D18 D32 D50 D78 D92 F73; G1934 G1854 G1843 D01 F73 D11 D10 D19 D18 D32 D76 D50 D93 F34; G1923 G1854 G1843 D01 D11 D10 D19 D18 D31 D50 D76 D90 F73; G1649-R D01 F07; G0997-R D01 F26 H0204; H0022 H0011; H0033 H0011; H0260; P1592- R F77 D01; S9999 S1309-R; P1581 P1570 P1592 H0260 F77 F78 D01; P1570-R F78 D01; P0635-R F70 D01; P1650 P1592 F77 D01; P1105-R D01 F07; P1616 P1592 F77 D01 N- 5A; P0839-R F41 D01 D63; P0760 P0635 P0839 H0260 F41 F70 D01 D63; P0953 P0839 P0964 H0260 F34 F41 D01 D63; P0964-R F34 D01; P0931-R P1592 P0839 H0260 H0011 H0044 F41 F77 D01 D63; P1058-R P1592 P0964 H0260 F34 F77 H0044 H0011 D01; P1649 P1592 F77 H0011 D01; P0862 P0839 F41 F44 D01 D63; P0942 P0931 P1592 P0839 H0260 H0011 H0044 F44 F77 D01 D63; P1605 P1592 F77 H0011 D01; P0055; L9999 L2528 L2506; L9999 L2028; L9999 L2824; S9999 S1434

- [002] . . .

LLDPE with 5-10% octene-1

R00936   Octene-1

H0215   Minor component

P1252   LLDPE

?/PI (R00936 (S) H0215) (L) P1252

** SS 1: Results 23

AN   -   1999-326517 [27]

TI   -   Process for preparing coupled polymer
                 useful as blown films, polymer additives etc.
                 - comprising heating admixture containing
                 polyolefins and optional comonomers
                 and poly(sulphonyl azide) coupler to at
                 least decomposition temperature

PI01   -   [001] 018; G0033-R G0022 D01 D02 D51
                 D53; S9999 S1285-R; L9999 L2528 L2506;
                 S9999 S1558; S9999 S1581; S9999 S1661;
                 A999 A782; A999 A680; A999 A293; S9999
                 S1387; L9999 L2391; L9999 L2835; M9999
                 M2835; H0000; H0011-R; P1150

        -        [002] 018; R00326 G0044 G0033 G0022 D01
                 D02 D12 D10 D51 D53 D58 D82; S9999 S1285-R;
                 L9999 L2528 L2506; S9999 S1558; S9999 S1581;
                 S9999 S1661; A999 A782; A999 A680; A999
                 A293; S9999 S1387; L9999 L2391; L9999 L2835;
                 M9999 M2835; H0000; H0011-R; P1150; P1161

        -        [003] 018; R00326 G0044 G0033 G0022 D01
                 D02 D12 D10 D51 D53 D58 D82; G0033-R G0022
                 D01 D02 D51 D53 D58 D83 D84 D85 D86 D87
                 D88 D89 D90 D91 D92 D93 D94 D95; G0817-R
                 D01 D51 D54; S9999 S1285- R; L9999 L2528
                 L2506; S9999 S1558; S9999 S1581; S9999
                 S1661; A999 A782; A999 A680; A999 A293; S9999
                 S1387; L9999 L2391; L9999 L2835; M9999
                 M2835; H0022 H0011; H0033 H0011; P1150

        -        [004] 018; R00326 G0044 G0033 G0022 D01
                 D02 D12 D10 D51 D53 D58 D82; R00936 G0044
                 G0033 G0022 D01 D02 D12 D10 D51 D53 D58
                 D88 H0215; S9999 S1285-R; L9999 L2528
                 L2506; S9999 S1558; S9999 S1581; S9999
                 S1661; A999 A782; A999 A680; A999 A293;
                 S9999 S1387; L9999 L2391; L9999 L2835;
                 M9999 M2835; H0022 H0011; P1252; P1150

        -        [005] 018; . . .

**Blend of propylene homopolymer with
propylene random copolymer**

R00964   Propylene

H0000   Homopolymer

K9745   Blend

H0113   Random copolymer

SS Results

1   27325   /PI R00964 (L) H0000
2   6453   /PI 1 (F) K9745
3   1449   /PI H0113 (L) R00964
4   769   /PI 3 (F) K9745
5   514   2 AND 4

AN   -   2000-516537 [47]

TI   -   Polypropylene resin composition useful
                 for producing film with good transparency,
                 impact resistance, low-temperatureheat
                 sealing properties and heat seal strength

PI01   -   [001] 018; R00964 G0044 G0033 G0022 D01
                 D02 D12 D10 D51 D53 D58 D83; H0000; S9999
                 S1285-R; S9999 S1387; P1150; P1343

        -        [002] 018; R00964 G0044 G0033 G0022 D01
                 D02 D12 D10 D51 D53 D58 D83; G0033-R
                 G0022 D01 D02 D51 D53 H0215; R00326
                 G0044 G0033 G0022 D01 D02 D12 D10 D51
                 D53 D58 D82 H0215; H0022 H0011; H0044-R
                 H0011; H0113 H0011; L9999 L2528 L2506;
                 S9999 S1285-R; S9999 S1387; P1150; P1285

        -        [003] 018; ND04; K9745-R; Q9999 Q7589-R;
                 Q9999 Q8366-R; B9999 B4397 B4240; B9999
                 B5265 B4740; B9999 B5312 B5298 B5276;
                 K9665; K9870 K9847 K9790; B9999 B4159 B4091
                 B3838 B3747; B9999 B4411 B4400 B4240;
                 B9999 B5243-R B4740; B9999 B3601 B3554;
                 B9999 B5107-R B4977 B4740; N9999 N6439

PI02   -   [001] 018; . . .;

Worked examples on STN

The following operators are used on STN:

boolean	and, or, not
3rd (widest) level of linking	(L)
2nd (middle) level of linking	(P)
1st (tightest) level of linking	(S)

Halogen containing Modifying agent

H0226   Modifying agent [polymer descriptors]

7A   Halogen [chemical aspects]

=> S (H0226 (P) 7A)/PLE

	23424	H0226/PLE
	94508	7A/PLE
L1	4739	(H0226 (P) 7A)/PLE

AN   2000-571984 [53]   WPIDS

TI   Fabric care composition, includes fabric enhancement system which comprises specified high molecular weight modified polyamine compounds.

PLE   UPA   20001023

[1.1]   018; R01176 G1650 G1649 D01 D23 D22 D31 D41 D50 D73 D82 F08 F07 F97 H0146; R00776 G2084 D01 D23 D22 D31 D41 D50 D77 D86 F71 H0146; G1343-R G1310 G4024 D01 D60 F37 F35 E00; G1809-R G1649 D01 F10 F07 D11 D10 D50; H0022 H0011; H0033 H0011; H0077 H0044 H0011; H0088 H0011; H0260; P0055; P0635- R F70 D01; P1116 P1105 D01 D10 F07; M9999 M2073; L9999 L2391; L9999 L2073; L9999 L2028; L9999 L2744 L2733; M9999 M2028; H0226

[1.2]   018; R00351 G1558 D01 D23 D22 D31 D42 D50 D73 D82 F47; R00370 G1558 D01 D11 D10 D23 D22 D31 D42 D50 D73 D83 F47; P0975-R P0964 F34 D01 D10; A999 A157-R; A999 A782; H0226; M9999 M2028; M9999 M2153-R; L9999 L2391; L9999 L2153-R; L9999 L2028

[1.3]   018; ND01; Q9999 Q7045 Q7034; Q9999 Q7114-R; K9518 K9483; K9676-R; K9687 K9676; K9712 K9676; K9745-R

[1.4]   018; B9999 B5094 B4977 B4740; B9999 B5287 B5276; B9999 B5367 B5276

[1.5]   018; R00798 G1570 G1558 D01 D11 D10 D23 D22 D31 D42 D50 D69 D73 D83 F47 Cl 7A; H0226

[1.6]   018; D01 D11 D10 D23 D22 D32 D73 D41 D50 D90 D91 D92 D93 D94 D95 F09 F07 F97 F94 F70; A999 A157-R

[2.1]   018; G0033-R G0022 D01 D02 D51 D53; H0000; H0011-R; S9999 S1014-R; S9999 S1025 S1014; P1150

[2.2]   018; ND01; Q9999 Q7045 Q7034; Q9999 Q7114-R; K9518 K9483; K9676-R; K9687 K9676; K9712 K9676; K9745-R

[3.1]   018; R00351 ....

Polyurethane foam from Toluene diisocyanate

P1592   Polyurethane

G1912   Toluene diisocyanate (gen)

S1309   Foam

=> S (P1592 (P) G1912 (P) S1309)/PLE

	36036	P1592/PLE
	2406	G1912/PLE
	26086	S1309/PLE
L1	555	(P1592 (P) G1912 (P) S1309)/PLE

AN   2000-571195 [53]   WPIDS

TI   Polyurethane composition for coating golf balls comprises a polyol, an aliphatic diisocyanate and a copolymer of aliphatic/aromatic polyisocyanate.

PLE   UPA 20001023

[1.1]   018; G1854-R G1843 D01 F73 D10-R G1912-R G1854 D11 D10 D19 D18 D31 D50 D76 D89; R01455 G1854 G1843 D01 D11 D10 D50 D88 F73; G1070-R G0997 D01 F29 F26; G1945-R G1843 D01 F73 D10-R D18-R; P1592-R F77 D01; S9999 S1309-R; H0033 H0011; L9999 L2528 L2506; L9999 L2824; L9999 L2391; L9999 L2073; M9999 M2073; S9999 S1627 S1605; L9999 L2664 L2506

[1.2]   018; ND01; Q9999 Q7114-R; Q9999 Q9063 Q9052; Q9999 Q9461 Q9052; K9416; B9999 B5287 B5276; B9999 B4262 B4240; B9999 B5301 B5298 B5276; N9999 N7147 N7034 N7023; N9999 N7067 N7034 N7023; K9483-R; B9999 B4615 B4568 K9847

[1.3]   018; C999 C000-R; C999 C306

[1.4]   018; A999 A544 A486; K9869 K9847 K9790

[1.5]   018; D01 D11 D10 D50 F23 D85; A999 A475

[1.6]   018; D01 D10-R D18-R F73; A999 A157-R

Cellulose fibre graft polymerised with an acrylic polymer former

G0260   Acrylics monoolefinic

H0146   Grafting polymer former

R01852   Cellulose

S1070   Fibre

=> S (G0260 (S) H0146)/PLE

	65051	G0260/PLE
	5304	H0146/PLE
L1	3384	(G0260 (S) H0146)/PLE

=> S L1 (P) (R01852 (P) S1070)/PLE

	11586	R01852/PLE
	58322	S1070/PLE
L2	22	L1 (P) (R01852 (P) S1070)/PLE

AN   2000-566123 [53]   WPIDS

TI   Production of superabsorber, useful for hygiene article, uses supercritical carbon dioxide in swelling and impregnation and fresh supercritical carbon dioxide during graft polymerization of acrylic acid and/or derivative(s) to cellulose.

PLE   UPA 20001023

[1.1]   018; G0260-R G0022 D01 D12 D10 D26 D51 D53 H0146; R00446 G0282 G0271 G0260 G0022 D01 D12 D10 D26 D51 D53 D58 D60 D83 F36 F35 H0146; R01852-R G3634 D01 D03 D11 D10 D23 D22 D31 D42 D50 D76 D86 F24 F29 F26 F34 H0293 P0599 G3623; H0011-R; H0088 H0011; L9999 L2528 L2506; S9999 S1070-R; S9999 S1514 S1456; P0088

[1.2]   018; ND03; Q9999 Q8004 Q7987; Q9999 Q9370; K9905; B9999 B4488 B4466; B9999 B3383-R B3372

[1.3]   018; R00426 D01 D11 D10 D50 D88 F12 F13; C999 C088-R C000; C999 C293

Multilayer packaging film from ethylene - vinyl alcohol with improved gas barrier properties

P1332   Ethylene - vinyl alcohol

S1285   Film

B4864   Impermeable

K9676   Multilayer

Q8366   Packaging

=> S (P1332 (P) S1285)/PLE

	1909	P1332/PLE
	46513	S1285/PLE
L1	789	(P1332 (P) S1285)/PLE

=> S (B4864 (L) K9676 (L) Q8366)/PLE

	11476	B4864/PLE
	133240	K9676/PLE
	34444	Q8366/PLE
L2	2863	(B4864 (L) K9676 (L) Q8366)/PLE

=> S L1 (L) L2

L3   285 L1 (L) L2

AN   2000-477294 [42] WPIDS

TI   Composition useful for making multilayer packaging materials with low oxygen permeability comprises an ethylene/vinyl alcohol copolymer, polyethylene and a polyethylene graft copolymer.

PLE   UPA 20000905

[1.1]   018; R00326 G0044 G0033 G0022 D01 D02 D12 D10 D51 D53 D58 D82; H0011-R; P1332 P1694; S9999 S1285-R; P1150

[1.2]   018; ND01; Q9999 Q8366-R; Q9999 Q8399-R Q8366; Q9999 Q8435 Q8399 Q8366; Q9999 Q7589-R; Q9999 Q7818-R; B9999 B4864 B4853 B4740; B9999 B4875 B4853 B4740; B9999 B4035 B3930 B3838 B3747; K9574 K9483; K9676-R

[2.1]   018; R00326 G0044 G0033 G0022 D01 D02 D12 D10 D51 D53 D58 D82; H0000; S9999 S1285-R; P1150; P1161

[2.2]   018; G0033-R G0022 D01 D02 D51 D53; R00326 G0044 G0033 G0022 D01 D02 D12 D10 D51 D53 D58 D82; G0033-R G0022 D01 D02 D51 D53; R00326 G0044 G0033 G0022 D01 D02 D12 D10 D51 D53 D58 D82; D51-R D60 F35-R G0022-R D01 D51 D53 H0146; H0011-R; P1252; H0124-R; H0011-R; P1241; H0088 H0011; H0124-R; S9999 S1285-R; P1150

[2.3]   018; ND01; Q9999 Q8366-R; Q9999 Q8399-R Q8366; Q9999 Q8435 Q8399 Q8366; Q9999 Q7589-R; Q9999 Q7818-R; B9999 B4864 B4853 B4740; B9999 B4875 B4853 B4740; B9999 B4035 B3930 B3838 B3747; K9574 K9483; K9676-R

[2.4]   018; B9999 B3601 B3554; B9999 B3612 B3554

[2.5]   018; Tr-R D62 D61; C999 C033 C000; C999 C293

Appendices

Appendix 1 – Summary of online files, fields and operators

	Derwent Innovation	Questel	STN
DWPI file	DWPI	WPIL; DWPI; DWPX	WPIDS; WPIX
Qualifier		/PI	/PLE
Linking Level operators			
LEVEL 1 Tightest Sentence		S	(S)
LEVEL 2 Middle Paragraph		P or L	(P)
LEVEL 3 Widest Field		F	(L)

Appendix 2 – Linking level table and examples

FACET	Polymer Type Pnnnn	Polymer Former Rnnnnn Gnnnn	Additive Annn	Catalyst Cnnn	Modifying Agent
Polymer Desc. Hnnnn	2	2	2	3†	3†	3†
H0146	2	1	1	N/A	N/A	N/A
H0215	2	1	1	N/A	N/A	N/A
H0204	2	N/A	1	N/A	N/A	N/A
Polymer Former Rnnnnn/Gnnnn	2	2	2	3†	3†	3†
Polymer Type Pnnnn	AND#	2	2	3†	3†	3†
Natural Polymer Rnnnnn/Gnnnn	2	2	2	3†	3†	3†
Modified Polymer Mnnnn	2	2	2	3†	3†	3†
Chemicals (non-polymeric) Rnnnnn/Gnnnn	3	3	3	2	2	2
Chemical Aspects Dnn Enn Fnn	2	N/A	1	2	2	2
Novelty Desc. NDnn	3	3	3	3	3	3
Universal Terms Knnnn	2/3	2/3	2/3	2/3	2/3	2/3
Shape & Form Snnnn	2	2	2	2	2	2
Chemical process Lnnnn	2	2	2	2	N/A	N/A*
Physical operations Nnnnn	3	3	3	2	2	N/A
Equipment Jnnnn	3	3	3	3	3	3
Properties Bnnnn	3	3	3	2	2	2
Applications Qnnnn	3	3	3	3	3	3

† When the Polymer former, Polymer type, Natural polymer or Modified polymer is functioning
as the Additive, Catalyst or Modifying agent - Use level 2 linking.

When more than one Polymer Type code is used to define ONE polymer - Use level 2 linking for all Polymer Type codes. When more than one Polymer Type code is present to describe more than one polymer, the codes for each Polymer type are ANDed together.

* Chemical processes for producing Modifying agent are not covered. The Modifying agent
would be linked using level 3 to chemical process for the polymer.

Examples of the use of Linking Levels

Polymer Type (2) Polymer Descriptor

Polyolefin Homopolymer
P1150 (2) H0000

Polyamide Graft copolymer
P0635 (2) H0088

Polysiloxane Ladder polymer (Polysilsesquioxane)
P8219 (2) H0179

Polyurethane Prepolymer
P1592 (2) H0259

Polymer Former (2) Polymer Descriptor

Epichlorohydrin Modifying agent
R00798 (2) H0226

Butadiene Elastomer
R00806 (2) H0124

Vinyl halide Random copolymer
G0544 (2) H0113

Lactone Homopolymer
G2131 (2) H0000

Polymer Type (2) Grafting polymer former

Polyester with a Grafting polymer former
P0839 (2) H0146

Polymer Type (2) (Grafting polymer former (1) Polymer Former)

Polyester grafted polymerised with acrylic acid
P0839 (2) (H0146 (1) R00446)

ABS by grafting styrene onto butadiene acrylonitrile backbone
P0191 (2) (H0146 (1) R00708)

Polymer Former (1) Grafting polymer former

Propylene Grafting polymer former
R00964 (1) H0146

Vinyl silane Grafting polymer former
G0691 (1) H0146

Polymer Former (2) Polymer Former (2) (Grafting polymer former (1) Polymer Former)

ABS by grafting styrene onto butadiene acrylonitrile backbone
R00806 (2) R00817 (2) (H0146 (1) R00708)

Polymer Type (2) Minor component

Polyester containing a Minor component
P0839 (2) H0215

LLDPE containing a Minor component
P1252 (2) H0215

Polymer Type (2) (Polymer Former (1) Minor component)

LLDPE containing 2-5% hexene
P1252 (2) (H0215 (1) R02043)

LLDPE containing ethylene and less than 5% other olefin
P1252 (2) R00326 (2) (H0215 (1) G0033)

Polymer Type (2) Macromer as polymer former

Polyimide containing a Macromer as polymer former
P1081 (2) H0204

Polymer Type (2) (Polymer Former (1) Macromer as polymer former)

Polyimide from a diaminopolysiloxane
P1081 (2) (G1796 (1) H0204)

Polyimide from pyromellitic dianhydride and diaminopolysiloxane
P1081 (2) R00556 (2) (G1796 (1) H0204)

Polymer Former (2) (Polymer Former (1) Macromer as polymer former)

Acrylated polyethylene oxide copolymerised with acrylic acid
(G0373 (1) H0204) (2) R00446 (2) H0011

Polymer Former (Rnnnnn) with Macromer as polymer former

Not Applicable - N/A
There are no macromers present as specific compounds

Polymer Former (2) Polymer Type

Propylene oxide in a Polyalkylene ether
R00370 (2) P0975

A diamine in a Polyamide
G1672 (2) P0635

A Polyamide from a diisocyanate
P0635 (2) G1854

Polymer Former (2) Polymer Former

Ethylene - Propylene
R00326 (2) R00964

Ethylene - Propylene Binary copolymer
R00326 (2) R00964 (2) H0022

An Acrylamide - Vinyl halide Copolymer
G0453 (2) G0544 (2) H0011

Metharylamide - Vinyl halide - Vinyl acetate
R00459 (2) G0544 (2) R00835

Polymer Type AND Polymer Type

Composition containing Polyamide and Polyurethane
P0635 AND P1592

Polymer Type (2) Polymer Type

Polyetheramide
P0964 (2) P0635

Polyesterketone
P0839 (2) P1149

Natural Polymer AND Polymer Type

All compounds in Natural Polymer hierarchy
autogenerate P0599 (Natural Polymer), because
this is autogenerated it is linked at level 1.

Composition containing Polysaccharide and PVA
G3623 AND P1707

Natural Polymer (2) Polymer Type

Starch - acrylic copolymer
R01863 (2) P0088

Natural Polymer (2) Polymer Former

Starch - Acrylonitrile Graft copolymer
R01863 (2) R00817 (2) H0088

Starch and Acrylic acid or salt Graft copolymer
R01863 (2) G0282(2) H0088

Modified Polymer (2) Polymer Type

Acrylated Epoxy resin
M2017 (2) P0464

Acrylated Epoxy resin by Esterification
M2017 (2) M2186 (2) P0464

Chlorinated Polyolefin
M2244 (2) P1150

Modified Polymer (2) Polymer Former

Imidated Maleic anhydride
M2335 (2) R00843

Imidated Maleic anhydride Copolymer
M2335 (2) R00843 (2) H0011

Epoxidised Butadiene Homopolymer
M2175 (2) R00806 (2) H0000

Chlorinated Olefin
M2244 (2) G0033

Chemicals (3) Polymer Type

PET containing Titanium dioxide
P0884 (3) R01966

Epoxy resin with Caprolactam
P0464 (3) R00776

Chemicals (3) Polymer Former

Calcium carbonate with Alpha-methyl styrene
R01278 (3) R00673

Calcium carbonate with Alpha-methyl styrene Block copolymer
R01278 (3) (R00673 (2) H0044)

Sulphur with Aliphatic conjugated diene Homopolymer
R01725 (3) (G0828 (2) H0000)

Chemical Aspects (2) Polymer Type

Sodium containing Polyarylate
Na (2) P0851

Bromine containing Polyurethane
Br (2) P1592

Chemical Aspects with Polymer Former (Rnnnnn)

All Chemical Aspects are autogenerated by the Specific
Compound Numbers (Rnnnnn) at level 1.There is no
advantage searching Chemical Aspects along with SCN.

Melamine
R00859 (1) D01 (1) D23 (1) D31 (1) D45 (1) D50
(1) D 76 (1) D83 (1) F07 (1) F10 (1) F19

Chemical Aspects with Polymer Former (Gnnnn)

A diamine containing at least one
benzene ring and an ether bond
G1672 (1) D19 (1) F34

Cycloaliphatic monoolefinic hydrocarbon
containing 8 - 10 Carbon atom
G0088 (1) (D88 OR D89 OR D90)

Shape & Form (2) Polymer Type

Polyester Textile fibre
P0839 (2) S1263

Polyurethane Foam Sheet
P1592 (2) S1309 (2) S1581

Polyethylene Film
P1161 (2) S1285

Shape & Form (2) Polymer Former

Styrene Foam
R00708 (2) S1309

Ethylene Homopolymer Film
R00326 (2) H0000 (2) S1285

Diolefinic Copolymer Filament
G0817 (2) H0011 (2) S1070

Universal Terms (2) Polymer Type

UV Crosslinked Polyolefin
K9869 (2) M2073 (2) P1150

Universal Terms (3) Polymer Type

Continuous Laminating of Polyester Film
K9392 (3) N7192 (3) (P0839 (2) S1285)

Universal Terms (2) Polymer Former

In-situ polymerisation of Methyl methacrylate
K9472 (2) L2573 (2) R00479

Universal Terms (3) Polymer Former

Coating tetrafluoroethylene (co)polymer onto glass
(R00975 (2) (H0000 OR H0011)) (3) N7034 (3)K9529

Polymer Type (2) Chemical process

Carbonisation of Phenol resin
L2108 (2) P0282

Polymer Former (2) Chemical process

Production of isobutylene polymer former by Isomerisation
R00966 (2) (L2471 OR H0271) (2) L2346

Production of Acrylonitrile by Ammoxidation
R00817 (2) L2040

Crosslinking of an Aromatic diolefinic copolymer
L2073 (2) G0840 (2) H0011

Polymer Type (3) Physical operation

Granulating Polyurea
N6144 (3) P1570

Injection moulding of PMMA
N6484 (3) P0113

Polymer Former (3) Physical operation

Injection moulding of PMMA
N6484 (3) (R00479 (2) H0000)

Injection moulding of a (meth)acrylate
N6484 (3) (G0340 OR G0384)

Polymer Type (3) Equipment

An Extruder for Unsaturated polyester
J5970 (3) P0873

Polymer Former (3) Equipment

Coating with TFE using a Roller
R00975 (3) N7034 (3) J2960

Polymer Type (3) Property

Ethylene - vinyl alcohol polymer with
good flexibility and permeability
P1332 (3) B4875 (3) B4035

Liquid crystal Polyester
B4331 (3) P0839

Polymer Former (3) Property

Heat stable Vinyl chloride homopolymer
B4682 (3) (R00338 (2) H0000)

Polymer Type (3) Application

HDPE for use in Packaging
P1194 (3) Q8366

Natural polymer for use in Prostheses
P0599 (3) Q8048

Polymer Former (3) Application

Vinyl halide Film for Agricultural use
(G0544 (2) S1285) (3) Q6702

Additive (3) Polymer Descriptor (Hnnnn)

Stabiliser for Thermosetting resin
A486 (3) H0328

Crosslinking accelerator for Elastomer
A146 (3) H0124

Additive (2) Polymer Descriptor

Caprolactam Homopolymer used as
Crosslinking agent for Epoxy resin
(R00776 (2) H0000 (2) A157) AND P0464

Catalyst (3) Polymer Descriptor (Hnnnn)

Catalyst for producing Block copolymer
C000 (3) H0044

Catalyst (2) Polymer Descriptor

Styrene - Divinyl benzene Catalyst support
for use in polymer modification
R00708 (2) G0851 (2) H0022 (2) C168 (2) C271

Modifying Agent (3) Polymer Descriptor (Hnnnn)

Adipic acid Modifying agent for Thermoplastic resin
(R01060 (2) H0226) (3) H0317

Modifying Agent (2) Polymer Descriptor

Caprolactam Homopolymer used as
Modifying agent for Epoxy resin
(R00776 (2) H0000 (2) H0226) AND P0464

Additive (3) Polymer Former

Stabiliser for vinyl chloride
A496 (3) R00338

Stabiliser for vinyl chloride resin
A486 (3) (R00338 (2) (H0000 OR H0011))

Polymer Type as Additive (for Polymer)

Polyester Reinforcing agent
P0839 (2) A419

Polyamide Crosslinking agent for Epoxy resin
(P0635 (2) A157) AND P0464

Additive (2) Chemicals

Dibutyl tin dilaurate stabiliser
R00415 (2) A486

Di t-butyl peroxide crosslinking agent
R00899 (2) A157

Catalyst (2) Chemicals

Dibutyl tin dilaurate catalyst for polyurethane production
(R00415 (2) C306) (3) P1592

Di t-butyl peroxide free radical catalyst
R00899 (2) C088

Modifying Agent (2) Chemicals

Chlorine Modifying agent
R01781 (2) H0226

Maleic anhydride modifying agent
R00843 (2) H0226

Additive (2) Chemical Aspects

Inorganic stabiliser containing tin
A486 (2) (D00 (1) Sn)

Azo foaming agent
F13 (2) A260

Catalyst (2) Chemical Aspects

Organic peroxide free radical catalyst
(D01 (1) F48) (2) C088

Modifying Agent (2) Chemical Aspects

Dibromomethane modifying agent
(D01 (1) D11 (1) D69 (1) Br (1) D81) (2) H0226

Additive (2) Shape & Form

Powder filler
S1514 (2) A237

Fibrous reinforcing agent
A419 (2) S1070

Catalyst (2) Shape & Form

Granular Catalyst support
S1503 (2) C168

Dispersion of Photocatalyst for Additive preparation
S1014 (2) C077 (2) C260

Modifying Agent (2) Shape & Form

Solution of Modifying agent
S1605 (2) H0226

Additive (2) Chemical process

Production of Carbon black pigment by Carbonisation
R05085 (2) A102 (2) L2108

Catalyst N/A Chemical process

Chemical processes for producing (non-polymeric) Catalysts are not covered

Modifying Agent (3) Chemical process

Chemical processes for producing Modifying agents are not covered

Epichlorohydrin modifying agent for epoxidation of a Phenolplast
(R00798 (2) H0226) (3) (L2175 (2) P0282)

Additive (2) Physical operations

Production of Filler by Granulating
N6144 (2) A237

Catalyst (2) Physical operations

Production of Catalyst support by Granulating
C168 (2) N6144

Modifying Agent N/A Physical operations

Physical operations for producing Modifying agents are not covered

Additive (3) Properties

Filler with very small particle size
A237 (2) B5209

Catalyst (3) Properties

Catalyst with irregular surface
C000 (2) B5378

Additive (3) Application

Polymer containing lubricant for use in magnetic tape
A340 (3) Q8899

Catalyst (3) Application

Coordination catalyst used to prepare isobutylene polymer used as fuel additive
C033 (3) (R00966 (2) (H0000 OR H0011)) (3) Q7636

Modifying Agent (3) Application

Acrylic acid modifying agent for PVA used in Adhesive tape
(R00446 (2) H0226) (3) P1707 (3) Q6633

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