Derwent World Patents Index®

Enhanced Polymer Indexing

Robert Austin – FIZ Karlsruhe

STN® STN is available through FIZ Karlsruhe, Germany and Chemical Abstracts Service, U.S.A.

Agenda

- Introduction and coverage
- Key features of polymer indexing
- Searching polymer indexing
- Essential user guides
- Search tips and indexing conventions
- Examples to try

DWPI Enhanced Polymer Indexing

- A deep indexing system covering all important polymer related information from DWPI basic patents
  - Both generic and specific concepts are indexed
- The indexing contains additional information not present in the DWPI abstract
  - Generates unique hits compared to text searching, IPC's etc.
- Replaced "Plasdoc Coding" in 1993
  - Coverage starts from DWPI update 199332
- Searchable by subscribers*
  - Using the /PLE field, in either WPIDS or WPIX

(* An appropriate level of Thomson Reuters subscription is required.)

STN

Example: DWPI polymer indexing

```
L1   ANSWER 1 OF 1  WPIX COPYRIGHT 2011       THOMSON REUTERS on STN
AN   2010-A01652 [201004]   WPIX
TI   Polishing pad for use in e.g. chemical mechanical planarization
     process has pores in polishing surfaces of polishing elements
     which are affixed to support layer to allow movement only along
     axis normal to polishing surface of elements
DC   A88; P61; U11
IN   JOSEPH W D
PA   (MINN-C) 3M INNOVATIVE PROPERTIES CO
PI   WO 2009158665   A1 20091230 (20100
ADT  WO 2009158665 A1 WO 2009-US48940 2
PRAI US 2008-75970P       20080626
PLE  UPA   20100115
     [1.1]     2004 G0828 G0817 D01 D12 D10 D51 D54 D56 D58 D69 D84
               Cl 7A DCN: R01079 DCR: 140524; H0000; H0124-R; S9999
               S1309-R; S9999 S1605-R; P0328; P0340;
     [1.2]     2004 G0102 G0022 D01 D02 D12 D10 D19 D18 D31 D51 D53
               D58 D76 D88 DCN: R00708 DCR: 368; G0828 G0817 D01
               D02 D12 D10 D51 D54 D56 D58 D84 DCN: R00806 DCR:
               129411; H0022 H0011; H0124-R; S9999 S1309-R; S9999
               S1605-R; P0328; P1741; P0351; P0362;
     [1.3]     2004 D01 D02 D03 D12 D10 D51 D53 D59 D85 P0599 H0124
               B5061 DCN: R24073 DCR: 135413; S9999 S1309-R; S9999
               S1605-R;
     [1.4]     2004 P1445-R F81 Si 4A; S9999 S1309-R; S9999 S1605-R;
     [1.5]     2004 ND01; K9416; Q9999 Q6600; K9870 K9847 K9790;
               B9999 B4397 B4240; ND07; K9745-R; B9999 B5221 B4740;
               N9999 N6484-R N6440; K9778 K9745; N9999 N6940 N6939;
               N9999 N6291 N6268; N9999 N6315 N6268; N9999 N6086; . . . .
```

DWPI polymer indexing is searched and displayed using the PLE field.

STN

Information indexed

- All polymer related information is indexed from:
  - The patent claims
  - DWPI documentation abstract
  - Claims related example(s)

Not covered

- Starting materials and intermediates for polymer formers and additives
- Chemical processes for catalyst production
- Generic or Markush Modifying Agents
- Starting materials, chemical processes, intermediates, or catalysts for modifying agent production
- Compounds present which are not additives, catalysts or modifying agents for the polymer
  - e.g. a cosmetic containing vitamin E and carboxymethylcellulose

Key features of polymer indexing (/PLE)

- Separate hierarchies (Facets) of related codes
  - Structural and Non-structural Facets
  - Each Facet has a unique code format
- Chemical aspects (fragment) codes for indexing chemical structures (polymers, additives, etc.)
- Auto-posting of codes to simplify searching
  - Up-posting of generic terms within code Facet
  - Cross-posting of related terms between Facets
- Precision linking of related terms
  - Using multiple proximity operators

Structural Facets (hierarchies)

	CODE FORMAT
• Polymer Formers – i.e. monomers and condensants	(Rnnnnn, Gnnnn)
• Polymer Types	(Pnnnn)
• Modified Polymers	(Mnnnn)
• Natural Polymers	(Rnnnnn, Gnnnn)
• Chemicals	(Rnnnnn, Gnnnn)
• Modifying Agents	(Rnnnnn, Gnnnn)
• Chemical Aspects – i.e. chemical fragment codes	(Dnn, Dnnn, Enn, Fnn, Fnnn)

Non-structural Facets (hierarchies)

	CODE FORMAT
• Novelty Descriptors	(NDnn)
• Universal Terms	(Knnnn)
• Polymer Descriptors	(Hnnnn)
– e.g. thermoplastic, graft copolymer	
• Shape & Form	(Snnnn)
– e.g. fibre, powder, foam	
• Additive Type	(Annn)
• Catalyst Type	(Cnnn)

STN

Non-structural Facets (hierarchies) (cont.)

	CODE FORMAT
• Chemical Processes	(Lnnnn)
• Physical Operations	(Nnnnn)
• Equipment	(Jnnnn)
• Properties	(Bnnnn)
• Polymer Applications	(Qnnnn)

STN

Chemical aspects (fragment) codes

- Chemical Aspects are chemical fragment codes indexed for:
  - specific compounds (in addition to the SCN)
  - generic compounds
  - Markush structures
  - atoms incorporated into a polymer by modification
- Chemical aspects index all polymers, additives, catalysts and modifying agents
- Code format
  - Dnn, Dnnn, Enn, Fnn, Fnnn
  - element symbols & groups

Chemical aspects codes (cont.)

- General terms
  - e.g. organic or inorganic
- Ring systems
  - number of rings
  - atoms in rings
  - size of rings
- Broad functionality terms
  - e.g. D60 - Acid
- C-C unsaturation

Chemical aspects codes (cont.)

- Carbon count
- Specific functionality terms (Fnn)
  - e.g. F70 - carboxylic amide
- Acid Derivative terms (Enn)
  - e.g. E21 - terephthalic derivatives
- Elements and groups of the periodic table
  - Including generic terms for General Metal & for Transition Metal

STN

Specific Compound Numbers (SCNs)

- Common fully defined compounds are indexed with their own specific codes – known as SCNs
  - Code format: Rnnnnn
  - e.g. R24001 – sodium acrylate
- The corresponding DWPI Chemistry Resource (DCR) numbers are also indexed and searchable
  - e.g. 135176 – sodium acrylate
- All polymer formers are indexed either by SCNs or generic codes (Gnnnn)

STN

Auto-posting of codes

- In addition to the codes chosen by the indexer, the online record contains related codes that are automatically indexed……
- Two types of auto-posting:
  - Up-posting
    - All broader codes further up the hierarchy from the indexed code are automatically indexed
  - Cross-posting
    - Related codes from other hierarchies are additionally indexed
- Benefit – easy generic searching

Example: Up-posting of codes

Polymer Formers

G0022 Monoolefinic

.....

G0260 NT Acrylics monoolefinic
(+ G0022 auto-posted)

G0271 NT Acrylic acids monoolefinic
(+ G0022, G0260 auto-posted)

G0282 NT Acrylic acid/salts
(+ G0022, G0260, G0271 auto-posted)

R00446 NT Acrylic acid
(+ G0022, G0260, G0271, G0282 auto-posted)

R24001 NT Sodium acrylate
(+ G0022, G0260, G0271, G0282 auto-posted)

```
PLE  UPA   20110302
     [1.1]     2004 G0282 G0271 G0260 G0022 D01 D12 D10 D26 D51 D53 D58
               D61 D83 F36 F35 Na 1A DCN: R24001 DCR: 135176; H0000; P0088;
```

Example: Cross-posting of codes

R24001 Sodium Acrylate CH2=CHCOONa

All relevant chemical aspect codes are auto-posted:

D01	Organic
D26	Acrylic unsaturated chain (96)
D12	Unsaturated chain
D10	Aliphatic chain
D53	Monoolefinic unsaturation
D51	Unsaturation containing
D58	Terminal olefinic unsaturation
D61	Salt/Complex
D83	Carbon Count
F36	Monocarboxylic acid (salt)
F35	Carboxylic acid (salt)
Na	Sodium
1A	Group 1A

```
PLE  UPA   20110302
     [1.1]     2004 G0282 G0271 G0260 G0022 D01 D12 D10 D26 D51 D53 D58
               D61 D83 F36 F35 Na 1A DCN: R24001 DCR: 135176; H0000; P0088;
```


Precision linking of related terms

- Each separate polymer concept is indexed with its associated terms (additives, catalysts, properties, applications, etc.) to form a “Linking group” of codes
- There may be several Linking groups included in the indexing – each Linking group represents a different polymer concept in the record
- Each Linking group is completely separated from other Linking groups in the record, maximizing precision and minimizing noise

Why are Linking groups important?

- **Example 1** - A patent describing a new bottle made from polyethylene terephthalate and having a cap made from polyolefin, e.g. polypropylene or ethylene copolymer.

  This patent has two polymer concepts (bottle and cap) and so would be indexed as two Linking groups.

- **Example 2** - A patent for a new tri-layer film, the outermost layer is heat resistant polyamide, the middle layer is aluminium and the inner layer is impermeable PVC.

  Again this patent has two polymer concepts (outer layer and inner layer), so two Linking groups would be made.

Three levels of linking

- All the codes within a single Linking group are linked together at **Level 3**
- **Level 2** and **Level 1** linking are used to indicate very closely related codes within a Linking group
  - e.g. “copolymer” linked to “acrylonitrile” and “butadiene”
- To search for codes from across different Linking groups (polymer concepts) the AND operator is used

Three levels of linking (cont.)

- **Level 3**: Widest level – a "Linking group"
  - Links related substances together
    - e.g. polymer with additive(s) or catalyst(s)
  - Links the polymer concept with properties and applications
- **Level 2**: Middle level – indexing for each substance
  - Links a compound with its function, shape or form
  - Links co-monomers together in a copolymer
- **Level 1**: Tightest level – Chemical Aspect (fragment) codes
  - Links structural fragments together within a substance

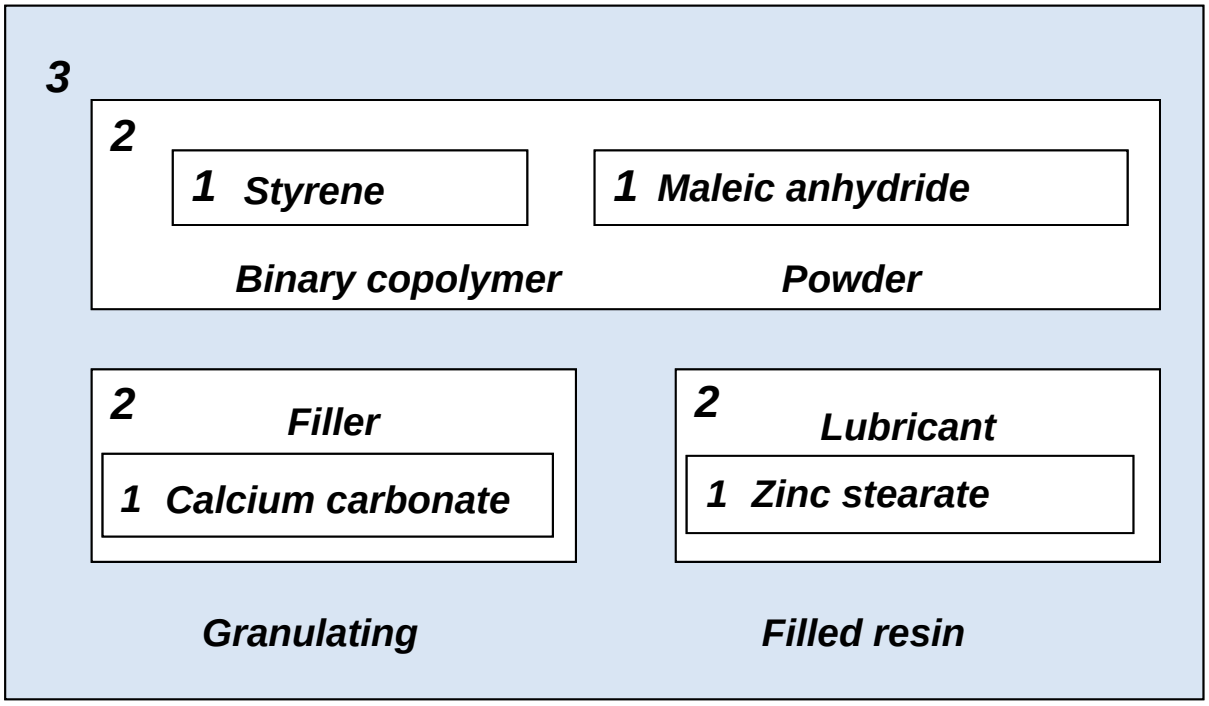
Three linking operators on STN

Linking level	Proximity operator	
(3) (widest)	(L)	Linking Group
(2) (middle)	(P)	Paragraph
(1) (tightest)	(S)	Sentence

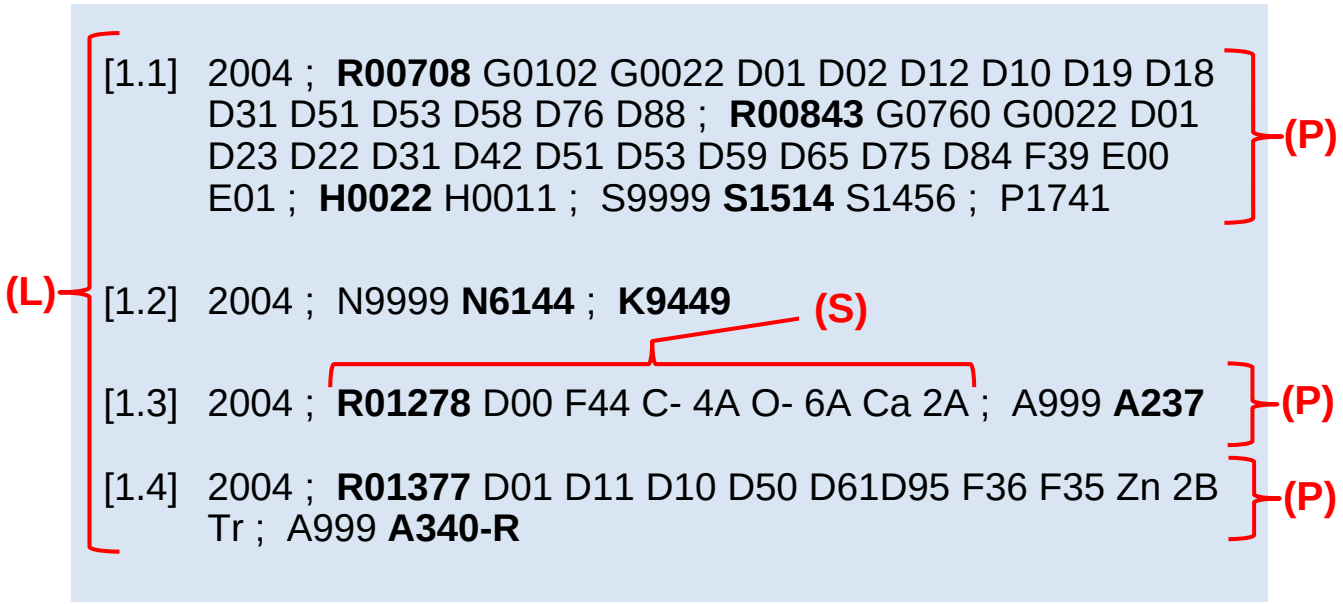
Hypothetical linking group example

- Polymer composition
  - Styrene-maleic anhydride binary copolymer
  - Calcium carbonate filler
  - Zinc stearate lubricant
  - Granulation into a powder
- Linking diagram
  - To help visualise the linking levels
- Format for an online record
  - What the indexing would look like online
- Format for a search strategy
  - How terms would be combined with operators

Linking group diagram for the example



The linking group example as it would look indexed in DWPI



The codes shown in **bold** are those which are intellectually indexed. All others are auto-posted codes.

The linking group example as it would look as a search strategy

L1: => S (R00708 (P) R00843 (P) H0022 (P) S1514)/PLE

L2: => S (R01278 (P) A237)/PLE

L3: => S (R01377 (P) A340)/PLE

L4: => S (N6144 (L) K9449)/PLE

L5: => S L1 (L) L2 (L) L3 (L) L4

L1 = polymer; L2 = filler; L3 = lubricant; L4 = granulating + filled resin.

Linking level table

- Example – Polymer Type codes link to Additive codes at level 3

FACET	Polymer Type Pnnnn	Polymer Rnnnnn	Former Gnnnn	Additive Annn	Catalyst Cnnn	Modifying Agent
Polymer Descriptor						
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†

Note: The full table showing linking levels for combining codes can be found in Appendix 2 of the Polymer Indexing System Description.

Searching for polymers

- Polymer formers
- Polymer types
- Modified polymers
- Natural polymers
- Chemical aspects

Addition polymers

- Addition polymers have monomer-based indexing
  - e.g. Polymethylmethacrylate:
    methylmethacrylate + homopolymer
    => S (R00479 (P) H0000)/PLE
  - e.g. Ethylene-propylene binary copolymer:
    ethylene + propylene + binary copolymer
    => S (R00326 (P) R00964 (P) H0022)/PLE
- Common addition polymers are also searchable as a single cross-posted polymer type code, e.g.
  - polymethylmethacrylate: => S P0113/PLE
  - ethylene-propylene binary copolymer: => S P1285/PLE

Addition polymers (cont.)

```
=> FILE WPIX

=> S (R00479 (P) H0000)/PLE
L1        30277 (R00479 (P) H0000)/PLE

=> S (R00326 (P) R00964 (P) H0022)/PLE
L2        18433 (R00326 (P) R00964 (P) H0022)/PLE

=> S P0113/PLE
L3        30277 P0113/PLE

=> S P1285/PLE
L4        18433 P1285/PLE
```

Search monomer indexing:
R00708 = Methylmethacrylate
R00326 = Ethylene
R00964 = Propylene
H0000 = Homopolymer
H0022 = Binary copolymer

Search Polymer Types:
P0113 = Polymethylmethacrylate
P1285 = ethylene-propylene binary copolymer

Condensation polymers

- Monomers/condensants are typically only indexed when stated in the patent
  - e.g. Polyethyleneterephthalate (PET) from ethylene glycol and terephthalic acid:

    PET + ethylene glycol + terephthalic acid + binary copolymer

    => S (P0884(P)R00822(P)R00702(P)H0022)/PLE

  - PET with no further monomer/condensant details is indexed as *PET* only: => S P0884/PLE

    I.e. for all references to PET, just search P0884

Condensation polymers (cont.)

```
=> FILE WPIX

=> S (P0884(P)R00822(P)R00702(P)H0022)/PLE
         74639 P0884/PLE
         17040 R00822/PLE
         13450 R00702/PLE
        262106 H0022/PLE
L1        1996 (P0884(P)R00822(P)R00702(P)H0022)/PLE

=> S P0884/PLE
L2       74639 P0884/PLE
```

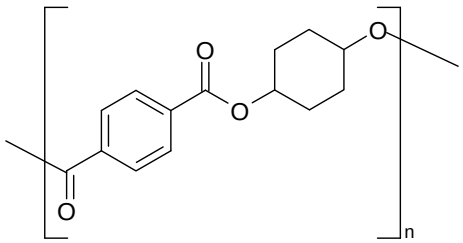
R00822 = Ethylene glycol
R00702 = Terephthalic acid
H0022 = Binary copolymer

P0884 = Polyethylene terephthalate (PET)

I.e. for all references to PET, just search P0884 (L2).

Condensation polymers (cont.)

- When no polymer formers are stated, polymers are often indexed by structural repeat unit (SRU)
  - e.g.



Indexed as:

(P1978 (2) D01 (2) D14 (2) D19 (2) D32 (2) D76 (2) D50 (2) D93 (2) E21 (2) F90)

i.e. polyester polymer type code + chemical aspects for the repeat unit

Each chemical aspect is indexed at Level (2) to the polymer type code.

Condensation polymers (cont.)

```
=> FILE WPIX
```

SRU search (L3) – see previous slide.

```
=> S (P1978-R (P) (D01 (S) D14 (S) D19 (S) D32 (S) D76 (S)
      D50 (S) D93 (S) E21 (S) F90))/PLE
L3          81 (P1978-R (P) (D01 (S) D14 (S) D19 (S) D32
               (S) D76 (S) D50 (S) D93 (S) "E21" (S) F90))/PLE

=> D HITPLE
```

Note: Each chemical aspect code is searched using (P) to the polymer type.

```
L3   ANSWER … OF 81  WPIX COPYRIGHT 2013 THOMSON REUTERS on STN
PLE  UPA   20070402
[2.1]  2004 E21 E00 D01 D11 D10 D19 D18 D14 D13 D32 D76 D50 D93
       D90 F90 F41 D31; S9999 S1581; H0293; P1978-R  P0839 D01
       D50 D63 F41;
```

Condensation polymers

- If polymer formers are stated, these are indexed
  - e.g. if the polymer from the previous slide is prepared from terephthalic acid and 1,4-cyclohexane diol

Indexed as:

(P1978 (2) R00702 (2) (G1069 (1) D01 (1) D14 (1) D31 (1) D76 (1) D50 (1) D86 (1) F28) (2) H0022)

i.e. polyester polymer type + terephthalic acid + (other diol + chemical aspects for cyclohexane diol) + binary copolymer

- For complete retrieval, search both SRU and monomer based indexing

Searching for additives

- Additives can be searched
  - by chemical composition
  - by function

Triethylphosphate heat stabiliser

=> S (R00424(P)A511)/PLE

```
PLE  UPA   20100806
     [1.5]     2004 G3327 D01 D11 D10 D50 D63 D86 F53 DCN: R00424
               DCR: 514; A999 A511 A486;
```

Searching for catalysts

- Catalysts can be searched:
  - by chemical composition
  - by type
  - by function

Potassium persulphate free radical initiator

=> S (R01737(P)C088)/PLE

```
PLE  UPA   20130813
     [1.4]     2004 D00 F48 F60 K- 1A O- 6A S- DCN: R01737 DCR:
               448; C999 C293; C999 C088-R C000;
```


Building search strategies

- Create separate search statements for each component
  - for polymeric components
  - for non-polymeric components
- Combine the statements together with the appropriate proximity operators

Building strategies (cont.)

Emulsion copolymerisation of a vinyl halide and an alpha-olefin using sulphonate dispersant

Polymer:

L1 => S (G0544 (P) G0033 (P) H0022 (P) L2551) /PLE

Additive:

L2 => S (A624 (P) F62) /PLE

Combine together:

L3 => S L1 (L) L2

```
PLE  UPA   20050831
     [1.7]     018 H0022 H0011; G0544 G0022 D01 D12 D10 D51 D53 D58 D69 D82
               Cl 7A DCN: R00338 DCR: 621; G0033-R G0022 D01 D02 D51 D53;
               L9999 L2551 L2506; L9999 L2675 L2506; S9999 S1025 S1014; S9999
               S1058 S1014; L9999 L2528 L2506; P1150; P1796;
     [1.13]    018 D01 D11 D10 D50 D60 D61-R F16 F35-R F62 F60 1A-R 2A-R;
               A999 A635 A624 A566; K9632 K9621;
```

39

Polymer Indexing display formats

PLE	All enhanced polymer indexing
HITPLE	Hit polymer indexing paragraphs
CODE (IND)	All patent classifications, Manual Codes, DCR indexing, chemical and polymer subscriber indexing
HITCODE	Hit classification codes, and hit subscriber indexing paragraphs

Example: HITPLE display

```
=> S (R00708(P)R00806(P)H0022)/PLE
L1       28211 (R00708(P)R00806(P)H0022)/PLE

=> D BIB HITPLE

L1   ANSWER … OF 28211  WPIX COPYRIGHT 2013       THOMSON REUTERS on STN
AN   2011-B76997 [201115]   WPIX
TI   Gel material for optical apparatus, contains transparent gel, and has
     specified hardness, penetration and repulsive force when surrounding
     surface of string-form gel material is contacted with light guide
     plate and light emitting element
DC   A89; L03; P81; Q71; U14; V07; X26
IN   MASUDA MASAHIKO; SAKURAI HIROHISA; SASAZAWA TAKAHIRO; SHIRATORI YUICHI
PA   (TAIC-N) TAICA CORP
PI   WO 2011019050   A1 20110217 (201115)* JA  98[41]
ADT  WO 2011019050 A1 WO 2010-JP63616 20100811
PRAI JP 2010-104807       20100430
     JP 2009-187696       20090813
PLE  UPA   20110302
     [2.3]     2004 G0102 G0022 D01 D02 D12 D10 D19 D18 D31 D51 D53
               D58 D76 D88 DCN: R00708 DCR: 368; G0828 G0817 D01
               D02 D12 D10 D51 D54 D56 D58 D84 DCN: R00806 DCR:
               129411; H0022 H0011; S9999 S1365; P0328; P1741; P0351;
```

R00708 = Styrene
R00806 = Butadiene
H0022 = Binary copolymer

Essential User Guides

- Polymer Indexing System Description
- Polymer Indexing Hierarchy
- Polymer Indexing Reference Manual
- Polymer Indexing Thesaurus

- Available in print or as PDF download from:

http://science.thomsonreuters.com/support/patents/userguides/polymerguides/

Documentation 'operators'

BT	Broader Term
NT	Narrower Term
UF	Used For
USE	*…directs the user to the preferred code concept*
SEE	*...nearest concept available*
SA	See Also
(96)	Code only available from Derwent update 199601
(04)	Code only available from Derwent update 200403
(2004)	Code only available from Derwent update 200403

Remember: Level (1) = (S), Level (2) = (P) and Level (3) = (L).

Polymer Indexing Hierarchy

- Concepts grouped by hierarchy
- Codes for all the primary terms
- Narrower Terms or sub-divisions (NT)
- Used For terms (UF) to indicate synonyms
- See Also terms (SA) for other related concepts
- Scope notes "..." to explain the use and limitation of the term

Example: Polymer Indexing Hierarchy

Physical Operations

N6611 **Process control**

N6622 NT Automation

UF Computer control

N6633 NT Temperature control

SA pH control

N6644 **Purging**

UF Flushing

Example: Polymer Indexing Hierarchy

Chemicals

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

Polymer Indexing Thesaurus

- Alphabetical listing of concepts
- All main concepts with hierarchies
- Secondary concepts (synonyms)
- Codes for both main and secondary concepts
- All relationships listed under the concepts
- Only the next level of Narrower or Broader Terms shown

Example: Polymer Indexing Thesaurus

A113 **Compatibility improver** [*additives*]

K9756 **Compatible polymer blend** [*universal terms*]

NT Interpenetrating network

BT Polymer blend

A124 **Complexing agent** [*additives*]

UF Chelating agent

UF Sequestering agent

{Compliance} [*properties*]

USE Rigidity properties B3930

Polymer Indexing Reference Manual

- Polymer Indexing Code list
  - alphanumeric order
  - including all autoposted terms
- Polymer Indexing Molecular formula list
  - molecular formulae for all SCNs with known structure
- Polymer Indexing Chemical Aspects - graphical definitions
  - graphical representation of certain chemical aspects

Searching using “-R”

- Codes that have narrow terms can either be auto-posted or manually indexed
  - these are codes at the top of a hierarchy
- When manually indexed, a “-R” suffix is added to these codes
- When auto-posted, no “-R” is added
- Searching for codes with a -R suffix will retrieve answers where the code has been manually indexed
  - auto-posted codes are not retrieved
  - the number of hits is reduced
- The Polymer Indexing Dictionary labels entries with -R as (general) and entries without -R as (all references)

Searching using “-R” (cont.)

Polymer Applications hierarchy

Q7603	**Friction materials**
Q7614	NT Brakes
Q7625	NT Clutches
Q7636	**Fuels**

=> S Q7603 /PLE

– retrieves all references to friction materials, (both manually indexed and auto-posted) including all brakes and clutches

=> S Q7603-R /PLE

– retrieves only manually indexed references to generic and other friction materials, *excluding* brakes and clutches

Dummy codes

- Autogenerated to indicate that a code from a certain hierarchy is present

A999	Additive
B9999	Properties
C999	Catalyst
J9999	Equipment
L9999	Chemical Processes
M9999	Modified Polymers
N9999	Physical Operations
Q9999	Applications
S9999	Shape & Form

- Note that there are no Dummy Codes for polymers
- Dummy codes provide an alternative to truncation,
  - e.g. => S A999/PLE is equivalent to => S A?/PLE

Modified polymers & modifying agents

- Modified polymers are indexed as the original un-modified polymer plus codes to index the modification
  - All linked at Level 2 (P)
- For modifying agents to be indexed they must be specifically referred to in the patent
- Most records online containing modified polymer indexing will therefore not include modifying agents
- To search for a modifying agent
  - link the chemical SCN or chemical aspects with modifying agent code (H0226) at Level 2 (P)

STN

Modifying agents & modified polymers

- To search for modified polymers
  - link the polymer with modified polymer codes (Mnnnn) at Level 2 (P)
- To link a modified polymer to a specific modifying agent
  - the modifying agent is indexed in a separate paragraph to the modified polymer, so
    - Search for the modified polymer
    - Search for the modifying agent SCN linked at Level 2 (P) to the modifying agent code (H0226)
    - Link the two search statements together at Level 3 (L)

STN

Modifying agents & modified polymers example

Brominated polyethylene – prepared by reacting bromine and polyethylene

- Search for bromine SCN as modifying agent
- Search for polyethylene + brominated polymer
- Link the searches together at Level 3 (L)

```
L1      => S (R01735 (P) H0226) /PLE
L2      => S (P1161 (P) M2233) /PLE
L3      => S L1 (L) L2
```

R01735	bromine SCN
H0226	modifying agent
P1161	polyethylene
M2233	brominated polymer

Polymerisation catalysts

- Search for the polymer which is produced using the catalyst
- Search for the catalyst type linking at Level 2 (P) to appropriate chemical aspects or SCN
- Link the polymer and catalyst search statements at Level 3 (L)

Polymerisation catalysts example

Production of polyolefins using metallocene catalyst

- Search for polyolefins using the polymer type code
- Search for the metallocene catalyst
- Link the searches at Level 3 (L)

```
L1      => S P1150 /PLE
L2      => S (D62 (P) C293) /PLE
L3      => S L1 (L) L2
```

P1150 polyolefin

D62 metallocene

C293 catalyst

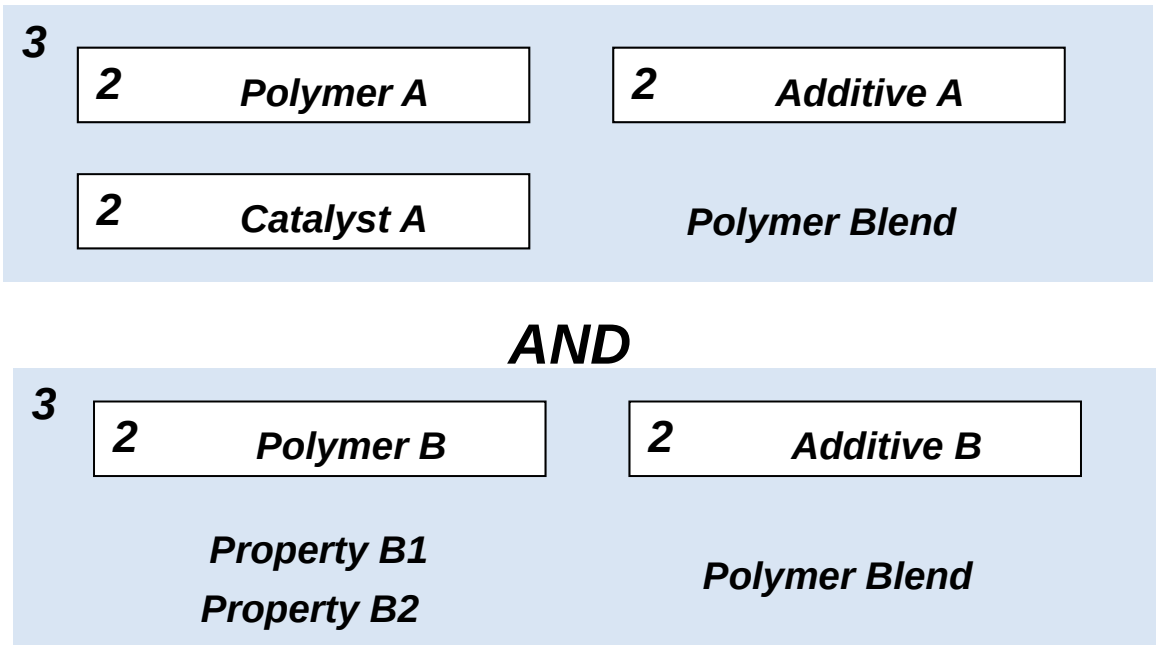
Polymer blends

- The polymer components are indexed in separate linking groups
- To search, create separate strategies for each component of the blend
  - Link each polymer at Level 3 (L) to the code for polymer blend (K9745)
- Combine the strategies with the AND operator
- This ensures that catalysts, additives, shape & form and properties are linked correctly to the relevant polymers

Example: Polymer blends

- Component 1 comprising:
  - Polymer A
  - Additive A
  - Catalyst A
- Component 2 comprising:
  - Polymer B
  - Additive B
  - Property B1
  - Property B2
- Linking diagram

Example: Polymer blends (cont.)



Polymer with polymeric additive

- The polymer and polymeric additive are indexed in separate linking groups
- Create separate strategies for polymer and polymeric additive
- Combine strategies using the AND operator

Polymer with polymeric additive

Example: polybutadiene roller containing PTFE powder lubricant

L1	=> S (R00806 (P) H0000) (L) Q8991) /PLE
L2	=> S (R00975 (P) H0000 (P) A340 (P) S1514) /PLE
L3	=> S L1 AND L2

R00806	butadiene; H0000 homopolymer
Q8391	roller
R00975	tetrafluoroethylene
A340	lubricant; S1514 powder

Note: Level 2 link between A340, R00975 and H0000.

Blend or polymeric additive?

- Polymer mixtures may be indexed as
  - polymer blends
  - polymeric additives to polymers
- This depends on the claimed nature of the mixture
- Search both ways to ensure complete retrieval

Example: Blend or polymeric additive?

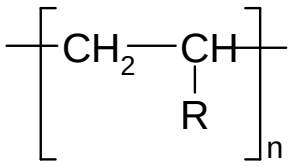
- Crosslinked epoxy resin containing phenoplast
  - Could be regarded as a blend of epoxy resin and phenoplast
  - Could be regarded as an epoxy resin containing a phenoplast crosslinking agent
- Search with both possibilities in mind to maximise retrieval

L1	Epoxy resin (L) (Polymer blend or Crosslinking agent)
L2	Phenoplast (L) (Polymer blend or Crosslinking agent)
L3	L1 AND L2

Polymer formers versus polymer types

- Many polymers have terms both for
  - the polymer former
  - the polymer type
- Using the simple polymer type code will only retrieve specific polymers
  - e.g. P1343 will retrieve only the homopolymer of polypropylene
- Using the polymer former code offers more flexibility in constructing search strategies
  - E.g. => S (R00964 (P) (H0000 OR H0011))/PLE will retrieve propylene homo- and copolymers

Generic / Markush polymer formers

- A group of polymer formers is often described using a Markush diagram
  - e.g. 

R = H, Me, Et, nPr
- Alternatively a generic phrase is used to describe the group of polymer formers
  - e.g. 2-5C aliphatic monoolefin
- However SCNs are only indexed when the polymer former is specifically mentioned

Generic / Markush polymer formers

- To retrieve Markush or generic references to a specific polymer former
  - Search with an appropriate generic polymer former code
  - Link the generic code at Level 1 (S) to chemical aspects for the specific polymer former
- This is more clearly explained using an example....

Generic / Markush polymer formers

All propylene polymers prepared using vanadium metallocene catalysts

L1	=> S ((**G0033 (S) D83**) (P) (H0000 OR H0011))/PLE
L2	=> S (C293 (P) (D62 (S) V))/PLE
L3	=> S L1 (L) L2

G0033	(Cyclo)aliphatic monoolefinic hydrocarbons
D83	Carbon count of 3
H0000	Homopolymer
H0011	Copolymer - all references
C293	Catalyst for polymerisation through C-C unsaturation
D62	Metallocene
V	Vanadium

Special cases for using Level 1 linking

- Three polymer descriptor codes which are linked at Level 1 (S) to a polymer former to indicate:
  - Polymer former as a minor component (H0215)
  - Grafting polymer former (H0146)
  - Macromer as a polymer former (H0204)
- These are exceptions to the general rule that polymer formers link at Level 2 (P) to polymer descriptors

Polymer former as a minor component

This is used for a polymer former which represents no greater than 10% of a copolymer.

E.g. Copolymer of ethylene and <5%hexene-1

```
L1      => S ( H0215 (S) R02043 ) /PLE
L2      => S L1 (P) ( R00326 (P) H0022 ) /PLE
```

R02043	hexene-1
R00326	ethylene
H0215	minor component
H0022	binary copolymer
(S), (P)	Level 1 and 2 links

Grafting polymer former

This is used to identify the grafting monomer in a graft copolymer.
E.g. alpha methyl styrene grafted onto styrene-isoprene copolymer

L1 => S (H0146 (S) R00673)/PLE
L2 => S L1 (P) (R00708 (P) R00429 (P) H0033 (P) H0088)/PLE

R00673 alpha methyl styrene

R00708 styrene; R00429 isoprene

H0146 grafting monomer

H0033 ternary or higher copolymer; H0088 graft copolymer

(S), (P) Level 1 and 2 links

Graft copolymers

- For graft copolymers only the final product is indexed
- Therefore in the previous example the polymer is:
  - indexed as a ternary or higher copolymer
  - not indexed as a binary copolymer of styrene and isoprene
  - but is still searchable as styrene-isoprene graft copolymer

Macromers

- There are two separate terms to define macromers
  - Macromer as polymer former (H0204)
    - A polymer former containing an oligomer or polymer which is modified to incorporate polymerisable functional groups
  - Macromer as modified polymer (H0191)
    - An oligomer or polymer modified to incorporate polymerisable functional groups
- Macromers are indexed in both ways to maximise retrieval

Macromer as polymer former

Copolymers of CH_2=CHCOO($CH_2CH_2O)_{20}$H and acrylic acid

Macromer is searched as an acrylate

L1	=> S (H0204 (S) G0373 (S) D11 (S) D95 (S) F27 (S) F34)/PLE
L2	=> S L1 (P) (H0011 (P) R00446)/PLE

H0204	macromer as polymer former
G0373	acrylic acid ester monoolefinic, other
D11	saturated chain
D95	carbon count >25
F34	ether
F27	monoalcohol
H0011	copolymer - all references
R00446	acrylic acid

Macromer as modified polymer

$CH_2=CHCOO(CH_2CH_2O)_{20}H$

Regarded as a modified polyether

L1 => S (H0191 (P) P0975 (P) R00351 (P) H0000)/PLE
L2 => S L1 (P) (M2017 (P) M2153 (P) M2186 (P) M2813)/PLE

H0191 macromer as modified polymer
P0975 polyalkylene ether
R00351 ethylene oxide
H0000 homopolymer
M2017 acrylated polymer
M2153 end group modified polymer
M2186 esterified polymer
M2813 unsaturation incorporated polymer

STN

Agenda

- Introduction and coverage
- Key features of polymer indexing
- Searching polymer indexing
- Essential user guides
- Search tips and indexing conventions
- Examples to try

STN

Examples to try (1-8)

1. Production of tubular film with controlled thickness by extrusion blowing

2. Nylon-6 fibre used for clothing

3. Equipment for cutting plastic sheet

4. Sodium carboxymethylcellulose used in fish farming

5. Polysulphone semipermeable membrane

6. Recycling polyolefin

7. Polyamide produced from adipic acid or derivative and an aliphatic diamine

8. Water repellent coating for metal

Examples to try (9-16)

9. Mica pigment

10. Thermoplastic polymer reinforced with cellulose fibre

11. Core-sheath fibre for fishing nets

12. Tyre compositions from a mixture of polyisoprene and natural rubber

13. Apparatus for mixing filler and thermoplastic polymer

14. Trimethylolpropane triacrylate copolymer for optical discs

15. Production of polyethylene using hydrogen as a chain regulator

16. Heat resistant aromatic polyester or polyarylate

Examples to try (17-24)

17. Catalyst for isobutylene preparation

18. Nickel catalyst for butadiene polymerisation

19. Modifying agent for acrylation of epoxy resin

20. Polymer containing biodegradable filler

21. Methylcellulose pressure sensitive adhesive

22. Triblock copolymer of isoprene and methacrylate

23. Polymeric tackifier for ethylene-propylene random copolymer

24. Aminoplast crosslinker for polyester

Examples to try (25-29)

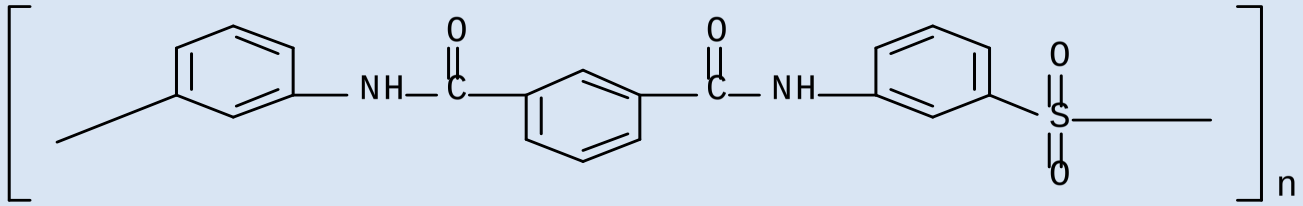
25. All references to propylene oxide

26. Oligomers of 1-vinylnapthalene

27. All references to fluoropolymers used as antifriction coatings

28. Homopolymer of 2,3-dichloro-1,3-butadiene

29. Polymers with this SRU



Answers to examples (1-8)

1. L1 S1296 (L) N5992 (L) B5243

2. L1 P0646 (P) S1070
   L2 L1 (L) Q7056

3. L1 J2915 (L) N6279 (L) S1581

4. L1 R07352 (L) Q7852

5. L1 P1490 (L) Q8060 (L) B4886

6. L1 P1150 (L) N6906 OR L1 G0033 (P) (H0000 OR H0011)
   L2 L1 (L) N6906

7. L1 G1672 (S) D10
   L2 L1 (P) P0635 (P) E13

8. L1 Q7114 (L) B3509 (L) K9552

Answers to examples (9-16)

9. L1 G3010 (P) A102

10. L1 R01852 (P) S1070 (P) A419
    L2 L1 AND H0317

11. L1 S1116 (L) Q7578

12. L1 R00429 (P) H0000
    L2 L1 (L) K9745 (L) Q9256
    L3 R24073 (L) K9745 (L) Q9256
    L4 L2 AND L3

13. L1 J2915 (L) N6439 (L) H0317 (L) (A237 OR A419)

14. L1 (H0011 (P) R05388) (L) Q8935

15. L1 R00326 (P) H0000 (P) L2573
    L2 R01532 (P) C215
    L3 L1 (L) L2

16. L1 B4682 (L) P0851

Answers to examples (17-24)

17. L1 C259 (L) R00966
    L2 L1 (L) L2471

18. L1 Ni (P) C293
    L2 R00806 (P) (L2573 OR L2528)
    L3 L1 (L) L2

19. L1 H0226 (L) (L2017 (P) P0464)

20. L1 B3021 (P) A237

21. L1 R01860 (P) Q6677

22. L1 H0066 (P) R00429 (P) G0384

23. L1 (A782 (P) A680) AND (R00326 (P) R00964 (P) H0113)

24. L1 (A157 (P) P0259 (P) A782) AND P0839

Answers to examples (25-29)

25. L1 R00370 OR (G1558-R (S) D83)

26. L1 G0237 (S) D20 (S) D92 (P) H0000 (P) H0237

27. L1 P0500 OR (H0000 OR H0011 OR P0000) (P) F
    L2 L1 (L) B5367 (L) Q7114

28. L1 G0839 (S) D69 (S) D84 (S) CL (P) H0000

29. L1 "E21“ (S) F61 (S) D94 (S) D33 (P) P0635 (polyamide with sulphone)
    L2 "E21“ (S) F94 (S) D94 (S) D33 (P) P1490 (polysulphone with amide)
    L3 "E21“ (S) D94 (S) D33 (P) P1489 (polysulphonamide)
    L4 L1 OR L2 OR L3

Resources

- DWPI on STN User Documentation
  http://www.stn-international.com/stn_dwpi.html
  - DWPI on STN Reference Manual
  - DWPI on STN Workshop Manual
  - DWPI Classification (DC) guide
  - Summary table of member level data coverage
  - Global Patent Sources – DWPI coverage in detail
  - Chemistry, Engineering and Polymer User Guides
- DWPI on STN database summary sheet
  http://www.stn-international.com/wpindex.html

STN

For more information …

CAS
E-mail: help@cas.org
Support and Training:
www.cas.org

FIZ Karlsruhe
helpdesk@fiz-karlsruhe.de
Support and Training:
www.stn-international.de

STN® STN is available through FIZ Karlsruhe, Germany and Chemical Abstracts Service, U.S.A.