Derwent World Patents Index®
Enhanced Polymer Indexing

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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.)

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 (201004)* EN  39
[1.1] 2004 G0828 G0817 D01 D12 D10 D51 D54 D56 D58 D69 D84 C1 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; 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; . . . . .
```
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)

```plaintext
<table>
<thead>
<tr>
<th>CODE FORMAT</th>
</tr>
</thead>
<tbody>
<tr>
<td>(Rnnnnn, Gnnnn)</td>
</tr>
<tr>
<td>(Pnnnn)</td>
</tr>
<tr>
<td>(Mnnnn)</td>
</tr>
<tr>
<td>(Rnnnnnn, Gnnnn)</td>
</tr>
<tr>
<td>(Rnnnnnn, Gnnnn)</td>
</tr>
<tr>
<td>(Rnnnnnn, Gnnnn)</td>
</tr>
<tr>
<td>(Dnn, Dnn, Enn, Fnn, Fnnn)</td>
</tr>
</tbody>
</table>

- i.e. monomers and condensants
- i.e. chemical fragment codes
```
Non-structural Facets (hierarchies)

**CODE FORMAT**

- Novelty Descriptors (NDnnn)
- Universal Terms (Knnnnn)
- Polymer Descriptors (Hnnnnn)
  - e.g. thermoplastic, graft copolymer
- Shape & Form (Snnnnn)
  - e.g. fibre, powder, foam
- Additive Type (Annnn)
- Catalyst Type (Cnnnn)

Non-structural Facets (hierarchies) (cont.)

**CODE FORMAT**

- Chemical Processes (Lnnnnn)
- Physical Operations (Nnnnnn)
- Equipment (Jnnnnn)
- Properties (Bnnnnn)
- Polymer Applications (Qnnnnn)
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

Specific Compound Numbers (SCNs)

- Common fully defined compounds are indexed with their own specific codes – known as SCNs
  - Code format: Rnnnnnn
  - 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 (Gnnnnn)
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

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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)
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

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

<table>
<thead>
<tr>
<th>Linking level</th>
<th>Proximity operator</th>
</tr>
</thead>
<tbody>
<tr>
<td>(3) (widest)</td>
<td>(L) Linking Group</td>
</tr>
<tr>
<td>(2) (middle)</td>
<td>(P) Paragraph</td>
</tr>
<tr>
<td>(1) (tightest)</td>
<td>(S) Sentence</td>
</tr>
</tbody>
</table>
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

[1.1] 2004; R00708 G0102 G0022 D01 D02 D12 D10 D19 D18
       D31 D51 D53 D58 D76 D88; R00843 G0760 G0022 D01
       D23 D22 D31 D42 D51 D53 D59 D65 D75 D84 F39 E00
       E01; H0022 H0011; S9999 S1514 S1456; P1741

[1.2] 2004; N9999 N6144; K9449

[1.3] 2004; R01278 D00 F44 C- 4A O- 6A Ca 2A; A999 A237

[1.4] 2004; R01377 D01 D11 D10 D50 D61 D95 F36 F35 Zn 2B
       Tr; A999 A340-R

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

<table>
<thead>
<tr>
<th>FACET</th>
<th>Polymer Type</th>
<th>Polymer Former</th>
<th>Additive</th>
<th>Catalyst</th>
<th>Modifying Agent</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Polymer Descriptor</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hnnnn</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>3†</td>
<td>3†</td>
</tr>
<tr>
<td>H0146</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>H0215</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>H0204</td>
<td>2</td>
<td>N/A</td>
<td>1</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td><strong>Polymer Former</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rnnnn/Gnnnn</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>3†</td>
<td>3†</td>
</tr>
<tr>
<td><strong>Polymer Type</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pnnnn</td>
<td>AND#</td>
<td>2</td>
<td>2</td>
<td>3†</td>
<td>3†</td>
</tr>
<tr>
<td><strong>Natural Polymer</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rnnnnnn/Gnnnnn</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>3†</td>
<td>3†</td>
</tr>
</tbody>
</table>

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

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## Searching for polymers

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

- Addition polymers have monomer-based indexing
  - e.g. Polymethylmethacrylate:
    \[
    \text{methylmethacrylate} + \text{homopolymer}
    \]
    \[
    \Rightarrow S (R00479 (P) H0000)/PLE
    \]
  - e.g. Ethylene-propylene binary copolymer:
    \[
    \text{ethylene} + \text{propylene} + \text{binary copolymer}
    \]
    \[
    \Rightarrow S (R00326 (P) R00964 (P) H0022)/PLE
    \]

- Common addition polymers are also searchable as a single cross-posted polymer type code, e.g.
  - polymethylmethacrylate: \(\Rightarrow S \ P0113/PLE\)
  - ethylene-propylene binary copolymer: \(\Rightarrow S \ P1285/PLE\)

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

Search monomer indexing:
- R00708 = Methylmethacrylate
- R00326 = Ethylene
- R00964 = Propylene
- H0000 = Homopolymer
- H0022 = 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:
    \[
    \text{PET} + \text{ethylene glycol} + \text{terephthalic acid} + \text{binary copolymer}
    \]
    \Rightarrow S (P0884(P)R00822(P)R00702(P)H0022)/PLE

- PET with no further monomer/condensant details is indexed as PET only: \Rightarrow S P0884/PLE

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

=> 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

P0884 = Polyethylene terephthalate (PET)
R00822 = Ethylene glycol
R00702 = Terephthalic acid
H0022 = Binary copolymer

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.

```
H

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.

=> FILE WPIX

```plaintext
=> 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.
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

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 $\Rightarrow$ S (G0544 (P) G0033 (P) H0022 (P) L2551) /PLE

**Additive:**

L2 $\Rightarrow$ S (A624 (P) F62) /PLE

**Combine together:**

L3 $\Rightarrow$ S L1 (L) L2

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**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]
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’

<table>
<thead>
<tr>
<th>BT</th>
<th>Broader Term</th>
</tr>
</thead>
<tbody>
<tr>
<td>NT</td>
<td>Narrower Term</td>
</tr>
<tr>
<td>UF</td>
<td>Used For</td>
</tr>
<tr>
<td>USE</td>
<td><em>directs the user to the preferred code concept</em></td>
</tr>
<tr>
<td>SEE</td>
<td><em>nearest concept available</em></td>
</tr>
<tr>
<td>SA</td>
<td>See Also</td>
</tr>
</tbody>
</table>

(96) Code only available from Derwent update 199601  
(04) Code only available from Derwent update 200403  

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

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### 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**

<table>
<thead>
<tr>
<th>Code</th>
<th>Term</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>A113</td>
<td><strong>Compatibility improver</strong></td>
<td><em>additives</em></td>
</tr>
<tr>
<td>K9756</td>
<td><strong>Compatible polymer blend</strong></td>
<td><em>universal terms</em></td>
</tr>
<tr>
<td></td>
<td>NT Interpenetrating network</td>
<td></td>
</tr>
<tr>
<td></td>
<td>BT Polymer blend</td>
<td></td>
</tr>
<tr>
<td>A124</td>
<td><strong>Complexing agent</strong></td>
<td><em>additives</em></td>
</tr>
<tr>
<td></td>
<td>UF Chelating agent</td>
<td></td>
</tr>
<tr>
<td></td>
<td>UF Sequestering agent</td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>{Compliance}</strong></td>
<td><em>properties</em></td>
</tr>
<tr>
<td></td>
<td>USE Rigidity properties</td>
<td>B3930</td>
</tr>
</tbody>
</table>
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)

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)
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

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Example: Polymer blends (cont.)

<table>
<thead>
<tr>
<th>3</th>
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<th>Polymer A</th>
<th>2</th>
<th>Additive A</th>
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<td></td>
<td>2</td>
<td>Catalyst A</td>
<td></td>
<td>Polymer Blend</td>
</tr>
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AND

<table>
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<tr>
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<th>2</th>
<th>Additive B</th>
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</tr>
<tr>
<td></td>
<td></td>
<td>Polymer Blend</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
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

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. \[
  \left[ \begin{array}{c}
  \text{CH}_2 \\
  \text{R} \\
  \text{CH} \\
  \end{array} \right]_n
  \]
  \( R = \text{H, Me, Et, nPr} \)

• 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....

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 modified polymer

\[ \text{CH}_2=\text{CHCOO(CH}_2\text{CH}_2\text{O})_{20}\text{H} \]

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

Agenda

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

\[
\left[\begin{array}{c}
\text{Ph} \quad \text{NH} \quad \text{C} \quad \text{O} \\
\text{Ph} \quad \text{NH} \quad \text{C} \quad \text{O} \\
\text{Ph} \quad \text{SO} \quad \text{O}
\end{array}\right]_n
\]
### Answers to examples (1-8)

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<td>1</td>
<td>L1</td>
<td>S1296 (L)</td>
<td>N5992 (L)</td>
<td>B5243</td>
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<td></td>
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<td>P0646 (P)</td>
<td>S1070 (L)</td>
<td>Q7056</td>
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<td>N6279 (L)</td>
<td>S1581</td>
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<tr>
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<td>L1</td>
<td>R07352 (L)</td>
<td>Q7852 (L)</td>
<td>L1</td>
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<tr>
<td>3</td>
<td>L1</td>
<td>P1490 (L)</td>
<td>Q8060 (L)</td>
<td>B4886</td>
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<td></td>
<td>L1</td>
<td>P1150 (L)</td>
<td>N6906 (L) OR L2</td>
<td>L1 (L) N6906</td>
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<tr>
<td>4</td>
<td>L1</td>
<td>G0033 (P)</td>
<td>H10000 OR H0011 OR H0011</td>
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<tr>
<td>5</td>
<td>L1</td>
<td>G1672 (S)</td>
<td>D10 (L)</td>
<td>L1 (P)</td>
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<td>6</td>
<td>L1</td>
<td>Q7114 (L)</td>
<td>B3509 (L)</td>
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<td>7</td>
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<td>L2</td>
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<td>8</td>
<td>L1</td>
<td>L1</td>
<td>L1</td>
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</tbody>
</table>
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
<table>
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<tr>
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<th>L1</th>
<th>L2</th>
<th>L3</th>
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</thead>
<tbody>
<tr>
<td>17.</td>
<td>C259 (L)</td>
<td>R00966</td>
<td>L1 (L) L2471</td>
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<tr>
<td>18.</td>
<td>Ni (P)</td>
<td>C293</td>
<td>R00806 (P) (L2573 OR L2528)</td>
</tr>
<tr>
<td>19.</td>
<td>L0226 (L)</td>
<td>L2017 (P)</td>
<td>P0464</td>
</tr>
<tr>
<td>20.</td>
<td>B3021 (P)</td>
<td>A237</td>
<td></td>
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<tr>
<td>21.</td>
<td>R01860 (P)</td>
<td>Q6677</td>
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<tr>
<td>22.</td>
<td>H0066 (P) R00429 (P)</td>
<td>G0384</td>
<td></td>
</tr>
<tr>
<td>23.</td>
<td>(A82 (P) A680) AND (R00326 (P) R00964 (P) H0113)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>24.</td>
<td>(A157 (P) P0259 (P) A782) AND P0839</td>
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</tr>
<tr>
<td>Example</td>
<td>Code/Value</td>
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</tr>
<tr>
<td>25.</td>
<td>L1 R00370 OR (G1558-R (S) D83)</td>
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<tr>
<td>26.</td>
<td>L1 G0237 (S) D20 (S) D92 (P) H0000 (P) H0237</td>
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</tr>
<tr>
<td>27.</td>
<td>L1 P0500 OR (H0000 OR H0011 OR P0000) (P) F</td>
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<td></td>
</tr>
<tr>
<td></td>
<td>L2 L1 (L) B5367 (L) Q7114</td>
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</tr>
<tr>
<td>28.</td>
<td>L1 G0839 (S) D69 (S) D84 (S) CL (P) H0000</td>
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<td>29.</td>
<td>L1 &quot;E21&quot; (S) F61 (S) D94 (S) D33 (P) P0635 (polyamide with sulphone)</td>
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<td>L2 &quot;E21&quot; (S) F94 (S) D94 (S) D33 (P) P1490 (polysulphone with amide)</td>
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<tr>
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<td>L3 &quot;E21&quot; (S) D94 (S) D33 (P) P1489 (polysulphonamide)</td>
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<tr>
<td></td>
<td>L4 L1 OR L2 OR L3</td>
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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

For more information …

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