Polyurethane dispersions for wood coating - Landscape Analysis

March, 2014
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Introduction

A polyurethane dispersion also known as PUD, is a colloidal dispersion made from either aliphatic or aromatic isocyanates, which can be produced with or without emulsifiers. It can be used in leather and wood finishes, PVC and concrete floor coverings, and textile coatings, and offers advantages including high tensile strength, high elasticity, high abrasion resistance, and stability within a wide temperature range. Polyurethane dispersions are preferably employed in the range of coatings as film formers or binders including adhesives, but also for producing other technical products. Because the polyurethane dispersions are considered environmentally friendly alternative to solvent-based binders, these have gained increasing importance in the manufacturing industry.

There are numerous reasons for the popularity of polyurethane coatings for wood applications. They have a high level of quality and fit perfectly with the natural properties of wood. In addition, they combine outstanding resistance to solvents and chemicals with unique toughness and flexibility. It is possible to formulate both clear coats and - because of their good pigment wetting properties - pigmented coatings, which yield high-gloss, high-bodied films with excellent flow properties. The films also have outstanding mechanical properties and provide the ideal balance of hardness and flexibility, even at low temperatures.

Good scratch resistance is another feature of polyurethane coatings.

This report aims to map out the patent landscape associated with Polyurethane dispersions for wood coating. This includes finding the major patent holders, geographical distribution of patents, top sub-technologies based on classification codes, sub-technology visualization using topic maps; as well as determining the patent transactions to obtain the key buyers and sellers in this technology area.

We have used Relecura to generate the data utilized in the various analyses and visualizations presented in this report.

Methodology

Patent search

1. The generation of the Polyurethane dispersions for wood coating patent landscape was initiated using the “URL based raw text search” of Relecura. The links given below were used for this purpose.
2. We then used “Seed Data” to look for the top representative classification codes, keywords, and concepts.

3. We similarly used “Explore” to look for additional keywords, concepts, and classification codes.

4. After identifying the relevant class codes from the above search, we used the “Classcode Finder” and “Landscape” options of Relecura to retrieve any classification codes we might have missed.

5. We added/removed the keywords, concepts, and classification codes (IPC and CPC code mentioned in step 9 below) which were relevant/irrelevant to Polyurethane dispersions for wood coating. This step gave us 5,106 equivalents (9,207 documents).

6. We separately conducted a keyword search in the Title-Abstract-Claims along with relevant IPC and CPC codes (mentioned in step 9 below) using the “Advanced Search” interface of Relecura with the following search string:

   (((wood OR wooden) AND (coating OR finishing OR polishing OR varnish OR paint)) AND ("polyurethane dispersion" OR "PU dispersion" OR "PUR dispersion" OR PUD OR polyurethane OR PU OR PUR))

   This step gave 2,115 equivalents (3,582 documents).

7. We separately conducted another keyword search in the Full text along with relevant IPC and CPC codes (mentioned in step 9 below) using the “Advanced Search” interface, with the search string given below.

   (((wood OR wooden OR woodware) AND (coating OR finishing OR polishing OR varnish OR paint)) AND ("polyurethane dispersion"~5 OR "PU dispersion"~5 OR "PUR dispersion"~5))

   This step gave us 2,363 equivalents (4,987 documents).

8. All the results from step 5 to step 7 were saved individually and combined to get the super set of Polyurethane dispersions for wood coating related patents and this gave us 8,382 equivalents (15,579 documents).
9. The list of IPC and CPC codes used to obtain results of step 5, step 6, and step 7 are given below:

**IPC Codes**: C08G 18/00, C08G 18/08, C08G 18/12, C08L 75/04, C09D 175/04, B05D 7/06, B05D 7/08, C08G 18/40, C08G 18/70, B27M 3/00, B32B 21/04, B32B 21/08, B32B 27/40, E04F 15/02, C08G 18/66, C09D 175/14, C09D 5/00, B05D 3/00, A47B 13/04, A47B 47/00, A47C 4/00, A47C 4/32, A47C 5/14, B05D 7/00, B05D 7/06, B27D 3/00, B27D 1/00, B27G 1/00, B27K 3/00, B60B 5/04, C09D 197/00, E04B 1/00, E04C 2/10, E04F 11/108, E04F 11/00, E04F 13/00, E04F 13/10, E04F 15/00, E04F 15/02, E04F 15/04, C08G 71/04, C08G 71/00

**CPC codes**: C08G 18/0819, C08G 18/0823, C08G 18/12, C08G 18/6659, C09D 175/04, B05D 3/067, B05D 7/06, C08G 18/6254, C08G 18/706, B05D 7/08, B32B 21/00, B44F 9/04, E04F 13/08, E04F 15/02, C09D 175/14, B27K 3/00, B27K 3/12, B27N 7/00, B27N 7/005, B32B 2255/08, C09D 197/00, D06N 3/0056, C08G 77/00, C08G 77/458, C08J 2207/04, C09J 2475/00, D06N 3/14

### Assignment search

The assignment database was searched to understand the transactions that have been recorded for patents addressing Polyurethane dispersions for wood coating.

1. The final set generated from the patent search was migrated to the assignment search section of Relecura to retrieve the transactions in this technology area. We received **4,858** transactions records.

2. The raw data from the above step was scrubbed within Relecura to get a relatively clean set of assignment transfers arising out of genuine patent transactions. For the clean-up of raw data pertaining to the recorded assignment transfers, please note the following points:
   a. The assignment transfers arising from a "change of name" have been removed.
   b. The assignment transfers from companies to banks, as collateral or security for financing, have not been considered.
   c. Note: For the steps above (a and b), we used Conveyance filed in “Advanced Search” interface of Relecura with the following string and removed the resultant set to obtain a clean set.

   ("change of name" OR security OR release OR lien OR correction)
   d. Inter-subsidiary transactions and transactions between parent companies and their subsidiaries have not been considered.
e. Inventor assignments (to the parent company) have not been considered.

f. **Note**: For above steps (c and d) we used “Browse feature” of Relecura and removed the inter-subsidiary transactions as well as inventor/individual assignments from search.

3. After cleaning the transaction records using the above procedure, we were left with **1,642 assignment transfers**.

The results from the patent search and assignment search were used in the following analyses.

Important notes:

a) The analysis of this report is based on the patent assets of various geographies, assignment transfer data provided by the USPTO, and related corporate information available in the public domain. All patent counts mentioned should only be considered indicative.

b) The graphs are based on a preliminary analysis as outlined above. The patent set may need to be refined, and the search strategy tweaked, to make the analysis more comprehensive.

**Patent Landscape Analysis**

**Patent filing trends**

![Figure 1. Filing trends for patents in Polyurethane dispersions for wood coating. The decline post 2011 is most likely due to the fact that filings in this period are yet to be published.](image)
Top patent holders

![Graph of Top patent holders in Polyurethane dispersions for wood coating patents.](image)

Figure 2. Top asset holders in Polyurethane dispersions for wood coating patents.

Top Assignee vs. Filing Year

![Graph of Filing trends for patents in Polyurethane dispersions for wood coating by Top Patent Asset Holder.](image)

Figure 3. Filing trends for patents in Polyurethane dispersions for wood coating—by Top Patent Asset Holder.

The above graph indicates that the filings in this technology area have consistently increased during the last decade. BAYER tops the list of patent holders and is a consistent player from early on in the area. Filings of some of the assignees like ASAHI KASEI have dropped in recent years, while others have been consistently active in the area. It is interesting to note that LUBRIZOL ADVANCED MATERIALS is a more recent and consistent player in the area.
Geographical distribution of patents

The chart given below provides the distribution of patents and applications by geography. The graph indicates that U.S., China and Europe followed by Canada are the top patent filing countries in Polyurethane dispersions for wood coating. A significant number of PCT applications are also filed in this technology area.

Figure 4. Geographical split of patent applications in Polyurethane dispersions for wood coating.

Figure 5. Geographical split of patent applications by top assignees in Polyurethane dispersions for wood coating.
Top CPC codes

![Figure 6. Top CPC codes of Polyurethane dispersions for wood coating patents.](image)

### Table 1. Description of CPC codes mentioned in Figure 6.

<table>
<thead>
<tr>
<th>CPC Class Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>C09D 175/04</td>
<td>Coating compositions based on polyureas or polyurethanes; Coating compositions based on derivatives of such polymers &gt; Polyurethanes</td>
</tr>
<tr>
<td>C08G 18/0823</td>
<td>Polymeric products of isocyanates or isothiocyanates &gt; with compounds having active hydrogen &gt; Processes &gt; Manufacture of polymers containing ionic or ionogenic groups &gt; containing anionic or anionogenic groups &gt; containing carboxylate salt groups or groups forming them</td>
</tr>
<tr>
<td>C08G 18/10</td>
<td>Polymeric products of isocyanates or isothiocyanates &gt; with compounds having active hydrogen &gt; Processes &gt; Prepolymer processes involving reaction of isocyanates or isothiocyanates with compounds having active hydrogen in a first reaction step</td>
</tr>
<tr>
<td>C08G 18/12</td>
<td>Polymeric products of isocyanates or isothiocyanates &gt; with compounds having active hydrogen &gt; Processes &gt; Prepolymer processes involving reaction of isocyanates or isothiocyanates with compounds having active hydrogen in a first reaction step &gt; using two or more compounds having active hydrogen in the first polymerisation step</td>
</tr>
<tr>
<td>C08G 18/792</td>
<td>Polymeric products of isocyanates or isothiocyanates &gt; with compounds having active hydrogen &gt; characterised by the isocyanates or isothiocyanates used &gt; Polyisocyanates or polyisothiocyanates &gt; having heteroatoms in addition to the isocyanate or isothiocyanate nitrogen and oxygen or sulfur &gt; Nitrogen &gt; characterised by the polyisocyanates used, these having groups formed by oligomerisation of isocyanates or isothiocyanates &gt; containing isocyanurate groups &gt; formed by oligomerisation of aliphatic and/or cycloaliphatic isocyanates or isothiocyanates</td>
</tr>
<tr>
<td>C09D 175/06</td>
<td>Coating compositions based on polyureas or polyurethanes; Coating compositions based on derivatives of such polymers &gt; Polyurethanes &gt; from polyesters</td>
</tr>
<tr>
<td>C08L 75/04</td>
<td>Compositions of polyureas or polyurethanes; Compositions of derivatives of such polymers &gt; Polyurethanes</td>
</tr>
<tr>
<td>C08G 18/283</td>
<td>Polymeric products of isocyanates or isothiocyanates &gt; with compounds having active hydrogen &gt; characterised by the compounds used containing active hydrogen &gt; Compounds having only one group containing active hydrogen &gt; Monohydroxy compounds &gt; Compounds containing ether groups e.g. oxyalkylated monohydroxy compounds</td>
</tr>
<tr>
<td>C08G 18/6659</td>
<td>Polymeric products of isocyanates or isothiocyanates &gt; with compounds having active hydrogen &gt; characterised by the compounds used containing active hydrogen &gt; Low-molecular-weight compounds having active hydrogen with high-molecular-weight compounds having active hydrogen &gt; Compounds of groups C08G18/42, C08G18/48, or C08G18/52 &gt; Compounds of group C08G18/42 &gt; with compounds of group C08G18/34</td>
</tr>
<tr>
<td>C09D 175/16</td>
<td>Coating compositions based on polyureas or polyurethanes; Coating compositions based on derivatives of such polymers &gt; Polyurethanes &gt; Polyurethanes having carbon-to-carbon unsaturated bonds &gt; having terminal carbon-to-carbon unsaturated bonds</td>
</tr>
</tbody>
</table>
### Table 2. Description of CPC codes mentioned in Figure 7.

<table>
<thead>
<tr>
<th>CPC Class Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>C09D 175/04</td>
<td>Coating compositions based on polyureas or polyurethanes; Coating compositions based on derivatives of such polymers &gt; Polyurethanes</td>
</tr>
<tr>
<td>C08G 18/0823</td>
<td>Polymeric products of isocyanates or isothiocyanates &gt; with compounds having active hydrogen &gt; Processes &gt; Manufacture of polymers containing ionic or ionogenic groups &gt; containing anionic or anionogenic groups &gt; containing carboxylate salt groups or groups forming them</td>
</tr>
<tr>
<td>C08G 18/12</td>
<td>Polymeric products of isocyanates or isothiocyanates &gt; with compounds having active hydrogen &gt; Processes &gt; Prepolymer processes involving reaction of isocyanates or isothiocyanates with compounds having active hydrogen in a first reaction step &gt; using two or more compounds having active hydrogen in the first polymerisation step</td>
</tr>
<tr>
<td>C08G 18/10</td>
<td>Polymeric products of isocyanates or isothiocyanates &gt; with compounds having active hydrogen &gt; Processes &gt; Prepolymer processes involving reaction of isocyanates or isothiocyanates with compounds having active hydrogen in a first reaction step</td>
</tr>
<tr>
<td>C08G 18/792</td>
<td>Polymeric products of isocyanates or isothiocyanates &gt; with compounds having active hydrogen &gt; characterised by the isocyanate or isothiocyanate nitrogen and oxygen or sulfur &gt; Nitrogen &gt; characterised by the polyisocyanates used, these having groups formed by oligomerisation of isocyanates or isothiocyanates &gt; containing isocyanurate groups &gt; formed by oligomerisation of aliphatic and/or cycloaliphatic isocyanates or isothiocyanates</td>
</tr>
<tr>
<td>C08G 18/283</td>
<td>Polymeric products of isocyanates or isothiocyanates &gt; with compounds having active hydrogen &gt; characterised by the compounds used containing active hydrogen &gt; Compounds having only one group containing active hydrogen &gt;</td>
</tr>
<tr>
<td>C08G 18/44</td>
<td>Polymeric products of isocyanates or isothiocyanates &gt; with compounds having active hydrogen &gt; characterised by the compounds used containing active hydrogen &gt; High-molecular-weight compounds &gt; Polycondensates having carboxylic or carbonic ester groups in the main chain &gt; Polycondensates</td>
</tr>
<tr>
<td>C08G 18/6659</td>
<td>Polymeric products of isocyanates or isothiocyanates &gt; with compounds having active hydrogen &gt; characterised by the compounds used containing active hydrogen &gt; Low-molecular-weight compounds having active hydrogen with high-molecular-weight compounds having active hydrogen &gt; Compounds of groups C08G18/42, C08G18/48, or C08G18/52 &gt; Compounds of group C08G18/42 &gt; with compounds of group C08G18/34</td>
</tr>
<tr>
<td>C08G 18/706</td>
<td>Polymeric products of isocyanates or isothiocyanates &gt; with compounds having active hydrogen &gt; characterised by the isocyanates or isothiocyanates used &gt; Isocyanates or isothiocyanates transformed in a latent form by physical means &gt; Dispersions of isocyanates or isothiocyanates in a liquid medium &gt; the liquid medium being water</td>
</tr>
<tr>
<td>C08L 75/04</td>
<td>Compositions of polyureas or polyurethanes; Compositions of derivatives of such polymers &gt; Polyurethanes</td>
</tr>
<tr>
<td>C08G 18/0828</td>
<td>Polymeric products of isocyanates or isothiocyanates &gt; with compounds having active hydrogen &gt; Processes &gt; Manufacture of polymers containing ionic or ionogenic groups &gt; containing anionic or anionogenic groups &gt; containing sulfonate groups or groups forming them</td>
</tr>
</tbody>
</table>
| C08G 18/672    | Polymeric products of isocyanates or isothiocyanates > with compounds having active hydrogen > characterised by the compounds used containing active hydrogen > Unsaturated compounds having active hydrogen > Unsaturated compounds having only one group containing active hydrogen > Esters of...
<table>
<thead>
<tr>
<th>CPC Class Code</th>
<th>Description</th>
<th>CPC Class Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>C09D 175/06</td>
<td>Coating compositions based on polyureas or polyurethanes; Coating compositions based on derivatives of such polymers &gt; Polyurethanes &gt; from polyesters</td>
<td>C08G 18/0866</td>
<td>Polymeric products of isocyanates or isothiocyanates &gt; with compounds having active hydrogen &gt; Processes &gt; Manufacture of polymers in the presence of non-reactive compounds &gt; in the presence of liquid diluents &gt; in the presence of a dispersing phase for the polymers or a phase dispersed in the polymers &gt; the dispersing or dispersed phase being an aqueous medium</td>
</tr>
<tr>
<td>C09D 175/16</td>
<td>Coating compositions based on polyureas or polyurethanes; Coating compositions based on derivatives of such polymers &gt; Polyurethanes &gt; Polyurethanes having carbon-to-carbon unsaturated bonds &gt; having terminal carbon-to-carbon unsaturated bonds</td>
<td></td>
<td>acrylic or alkyl acrylic acid having only one group containing active hydrogen</td>
</tr>
</tbody>
</table>

**Figure 9. Topic Map based on concepts.**
Topic Map – Technologies

Figure 10. Topic Map based on technologies.
Assignment Landscape Analysis

USPTO’s assignment dataset was searched for various transactions carried out on patents addressing *Polyurethane dispersions for wood coating* and the results of the search are used to create a transaction landscape.

Patent transaction trends

*Figure 12. Overall transaction trend for patents in Polyurethane dispersions for wood coating.*

Top transacted assignors (Sellers)

*Figure 13. Top transaction assignors (Sellers) in Polyurethane dispersions for wood coating.*
Top transacted assignees (Acquirers)

![Top Normalized Transaction Assignees](image)

**Figure 14.** Top transaction assignees (acquirers) in Polyurethane dispersions for wood coating.

Transaction Assignor vs. Assignee

![Assignment Transfer Matrix](image)

**Figure 15.** Assignment transfer matrix – Assignor vs. Assignee for Polyurethane dispersions for wood coating patents.
Top transaction assignee by executed year

Figure 16. Buyers for patents in Polyurethane dispersions for wood coating with trends.

Top transaction assignor by executed year

Figure 17. Sellers for patents in Polyurethane dispersions for wood coating with trends.
Summary

Polyurethane dispersions have become the preferred material for coating many materials, apart from other applications. However, given this material’s quality level, and similarity to the natural properties of wood, it provides a suitable coating for wooden surfaces.

Understandably, several organizations are working in this technology area, and bringing about innovative improvements. Hence, patents filings have picked up considerably in the last one decade, with 2011 witnessing approximately 650 patent publications.

The organization Bayer tops the list of patent holders in this domain, and has been quite consistent in filing patents. However, the company Asahi Kasei has seen a drop in their patent filings in the recent years. On the other hand, Lubrizol Advanced Materials, a new entrant in this sector has been active in patent filings.

While US leads the race of patent filings with a huge margin, China and EP stand together right behind. Following them is Canada, after which there is a good number of PCT filings.

We studied these patents in detail, and found Polymer, Solvent, Amine and Isocyanate as the most occurring concepts, while “Macromolecular compounds other than carbon-carbon unsaturated bonds” and “coatings, fillers, and inks” appeared as the top technology areas.

In addition, assignment transfers show a large number of patent transactions recorded in this domain, where Dupont is the top assignor (seller), and US Coatings is the top assignee (acquirer).

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