Technology Landscape [Sample]

Rubber Based Adhesives

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1. INTRODUCTION

1.1 RUBBER BASED ADHESIVES

Rubber based adhesives are the adhesives made using rubber (both natural and synthetic, high molecular weight rubbers or elastomers) as the base material. The rubber based adhesives are generally used as solvent-based solutions, latex, cements, and pressure-sensitive tapes.

Rubber based adhesives scores over the acrylic or silicone based adhesive products by being more cost effective. They have more tackiness or stickiness as compared to acrylic or silicone adhesives. The soft nature of these adhesives allows them to have the ability to wet out and flow into a substrate much better especially with textured. The hydrophobic property of rubber based adhesives are at an advantage in humid atmosphere. Rubber based adhesives are ideal for indoor applications as they can adhere to a wide variety of substrates and provide strong adhesion to materials with high- and low-surface energy.

Rubber based adhesives can be divided into two classes, namely

- **Synthetic rubber based adhesive**
- **Natural rubber based adhesive**

Natural rubber (NR), also known as India rubber, latex, Amazonian rubber is composed of polymers of isoprene, along with water and some other organic compounds. NR has many uses in adhesive tape applications owing to its outstanding peel adhesion or grab for both polar and low surface tension surfaces. Moreover, adhesive tape with natural rubber can be removed quite easily without leaving a trace. Finally, NR based adhesives possesses high tack or stickiness which is highly beneficial for adhesive tapes requiring minimal pressure and time.

A synthetic rubber is an artificial elastomer which is made from various petroleum based monomers. Usually as compared to the natural rubber, the synthetic rubbers have more thermal stability and has better compatibility with petroleum products.
1.2 MARKET POTENTIAL

The Rubber based adhesive market was estimated at USD 56.59 billion in 2018 and is now projected to reach USD 71.99 billion by 2023, at a CAGR of 4.93% between 2018 and 2023. The market for the rubber based adhesives is driven by the growth of the automobile and the electronic industry.

In the Asia-Pacific region, China has taken a lead in the demand for adhesive tapes whereas in the Europe, the demand of the building and construction industry is fuelling the demand for adhesive tapes. Some of the key players operating in the global rubber based adhesive market includes, Swabs Tapes India Private Limited, MBK Tape Solutions, PPM Industries SpA, Godson Tapes Pvt. Limited, 3A Associates Incorporated, 3M Company, Tesa SE and Intertape Polymer Group, Inc

*Patent data shows 46% of total publication is pending applications. Higher percentages of applications point to a growing market*
2. OBJECTIVE

- To perform detailed analysis of patenting activity pertaining to rubber based adhesives and to understand underlying technologies.
- To generate useful insights pertaining to rubber based adhesive technological field of study for the researchers at industry.
- Graphical representation of trends (Filing, Publication, etc.) from the mined data of relevant patents/applications.

3. SEARCH METHODOLOGY

The first step is to create and define a patent set that will serve the basis of the study. Patent databases like Derwent Innovation were used as our data sources. Search was carried out in Abstract, Title, and Claims fields of patent specifications by incorporation of Keywords and International Patent Classes.
4. SUMMARY

This report explores the global landscape of patents/patent applications pertaining to rubber-based adhesives.

A set of 397 patent families (that bifurcates to a total of 2587 individual patents/applications) filed in the rubber-based adhesive domain were analyzed.

Patent publications particularly have focus on pressure sensitive adhesives (28%), liquid compositions (83%), solvent-based adhesives (89%), ethyl acetate (47%) as solvent, synthetic rubber (53%), neoprene (93%) as type of synthetic rubber, and electronic industry (15%) as major application area.

Volgograd State Technical University is the top global innovator in this domain with 35 patent families followed by Bridgestone having 32 patent families.

Japan with 190 patent applications is the largest filing destination.
5. NON-TECHNICAL ANALYSIS

5.1 PRIORITY, FILING, PUBLICATION YEAR BASED TREND ANALYSIS

Filing trend indicate a sudden spike of about 300% in the year 2008 which may be attributed to prolific filing by Volgograd State Technical Univ (16 patents/applications) and Bridgestone (14 patents/applications) during this period predominantly in RU (16 patents/applications) & JP (12 patents/applications) jurisdictions in the field of pressure sensitive rubber based adhesives (7 patents/applications) and neoprene synthetic rubber based adhesive (12 patents/applications).

# Note: Attributed to non-published patent applications, there may be a higher count in the years 2019-2020
5.2 ASSIGNEE BASED TREND ANALYSIS

5.2.1 Major Assignees (Based On Representative Member Per Family)

The below graph represents major assignees in the domain.

Besides, Volgograd State Technical University (35 patents/applications) which is the top applicant/assignee, all other key applicants/assignees are companies with majority of them are Asia based. Volgograd State Technical University has all its filings originating in Russian jurisdiction with majority of the patents/applications belonging to the domain of neoprene synthetic rubber based adhesive (26 patents/applications).
Trend related to geographical filings demonstrate that the maximum number of filings had their origin in Asia with Japan emerging as the top jurisdiction. Nitto Denko (31 patents/applications) is the top assignee in JP jurisdiction primarily focusing in the domain of pressure sensitive rubber based adhesives (29 patents/applications).
5.4 INTERNATIONAL PATENT CLASSIFICATION BASED TREND

The IPC sub-class definitions are provided in Appendix B.
6. TECHNICAL ANALYSIS

6.1 TAXONOMY DEVELOPED FOR BUCKETING OF RELEVANT PATENT DOCUMENTS

A set of 397 patent families were analyzed in depth to identify the focus areas of the patents related to Rubber Based Adhesives.

![Diagram of Rubber Based Adhesives]

- **Adhesive Type**
  - Hot Melt
  - Pressure Sensitive
  - Generic

- **Type of Composition**
  - Liquid Composition
  - Solid Composition
  - Water Based
    - Toluene
    - Ethanol
    - Acetone
    - MEK
    - Ethyl Acetate
    - Xylene
    - Hexane
    - Cyclohexane
    - Heptane
    - Petroleum
    - Generic

- **Type of Rubber**
  - Natural Rubber
    - SBR
    - Nitrile Rubber
    - Neoprene
    - Butyl Rubber
    - Butadiene Rubber
    - PIB
    - Acrylic Rubber
    - SBS
    - EPDM
    - SIS
    - SEBS
    - SEBS
    - Generic
  - Synthetic Rubber

- **End-User Industry**
  - Automobile
  - Construction
  - Furniture
  - Footwear
  - Textile
  - Electronic
  - Generic
6.2 DISTRIBUTION OF PATENTS/APPLICATIONS PERTAINING TO RUBBER BASED ADHESIVES

Amongst the specific adhesive types, maximum number of patents/applications disclose pressure sensitive rubber based adhesives mostly derived from natural rubber (58%).

6.3 DISSECTION OF PATENTS/APPLICATIONS PERTAINING TO ‘TYPE OF COMPOSITION’

Maximum number of patents/applications are disclosing solvent based liquid adhesive compositions.
6.4 DISSECTION OF PATENTS/APPLICATIONS PERTAINING TO ‘SOLVENT’ USED IN RUBBER BASED ADHESIVES

Maximum number of patents/applications are disclosing use of non polar solvents such as toluene (37), petroleum (36), hexane (15), xylene (12), cyclohexane (11) and heptanes (8), for the preparation of liquid rubber based adhesive compositions.
6.5 DISSECTION OF PATENTS/APPLICATIONS PERTAINING TO ‘TYPE OF RUBBER’

As evident from the chart, maximum number of patents/applications are disclosing use of Neoprene (17%), Butyl Rubber (14%), Nitrile rubber (12%) and SBR (11%) as the type of synthetic rubber for the preparation of rubber based adhesives.
A significant number of patents/applications are disclosing use of rubber based adhesives in Electronics (15%) and Automobile (14%) sector.
7. PATENT PORTFOLIO ANALYSIS

7.1 BRIDGESTONE

Company Profile

Bridgestone is a Japanese multinational auto and truck parts manufacturer and is one of the largest manufacturer of tyres in the world.
7.2 NITTO DENKO

Company Profile

NITTO DENKO is a Japanese company that produces tapes, vinyl, LCDs, insulation, and several other products. Adhesion technology is one of the core technologies on which Nitto Denko is working which includes Adhesive Design, Adhesion Property Evaluation, Layering, Release, Substrate Design and Adhesive Synthesis.
Company Profile

LG formerly Lucky-Goldstar is a South Korean multinational conglomerate corporation. LG Chem is involved in manufacturing of Pressure sensitive adhesive, Butadiene Rubber, NBR LATEX, Styrene Butadiene Rubber, SBS, SB LATEX, etc.

ADHESIVE TYPE

- Generic 72%
- Pressure Sensitive 24%
- Hot Melt 4%

TYPE OF RUBBER

- Synthetic Rubber 76%
- Natural Rubber 24%

SYNTHETIC RUBBER

- Neoprene 3%
- SBR 12%
- Nitrile Rubber 7%
- Butadiene Rubber 12%
- SBS 14%
- PIB 2%
- Acrylic Rubber 9%
- EPDM 2%
- Butyl Rubber 23%

END-USER INDUSTRY

- Electronics 56%
- Automobile 16%
- Generic 28%
- Plastics and Rubber 9%
## 8. Key Patents Assigned to Educational Institutes

<table>
<thead>
<tr>
<th>Patent No.</th>
<th>Field of Invention</th>
</tr>
</thead>
<tbody>
<tr>
<td>KR20190091865A</td>
<td>The patent application relates to an adhesive composition used in temperature insensitive-type adhesive tape, comprises first rubber containing un-vulcanized natural rubber, second rubber made of synthetic rubbers, tackifying resin, anti-aging agent, and chloroprene rubber</td>
</tr>
<tr>
<td>KONGJU NATIONAL UNIV</td>
<td></td>
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<tr>
<td>RU2448997C2</td>
<td>The patent document relates to an adhesive composition based on chloroprene rubber, which can be used in the rubber industry when gluing together vulcanised rubber based on different rubber.</td>
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<tr>
<td>VOLGOGRAD STATE TECHNICAL UNIV</td>
<td></td>
</tr>
<tr>
<td>RU2374286C1</td>
<td>The patent document relates to an adhesive composition contains polychloroprene rubber, nairit, butylphenolformaldehyde resin, zinc oxide, magnesium oxide, water and organic solvent.</td>
</tr>
<tr>
<td>VOLGOGRAD STATE TECHNICAL UNIV</td>
<td></td>
</tr>
<tr>
<td>CN108165205A</td>
<td>The patent document relates to a hot melt adhesive composition comprises high diene monomer content rubber, maleic anhydride-modified thermoplastic elastomer, tackifying resin, processing oil, filler, vulcanizing agent, and vulcanization auxiliary agent.</td>
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<tr>
<td>BEIJING RUBBER INDUSTRY RES DESIGNING INSTITUTE</td>
<td></td>
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<tr>
<td>RU2527223C1</td>
<td>The patent document relates to an adhesive composition based on butadiene-nitrile rubber with content of acrylic acid nitrile 18% or 28%.</td>
</tr>
<tr>
<td>MOSCOW STATE UNIVERSITY</td>
<td></td>
</tr>
</tbody>
</table>
9. APPENDIX A - REFERENCES & CREDITS

5. https://www.specbond.com/
11. Hand Book of Adhesives and Sealants, Page 300, Edward. W. Petrei
13. Adhesives & Sealants Market by Adhesive Formulating Technology (Water-Based, Solvent-Based, Hot-Melt, Reactive), Sealant Resin Type (Silicone, Polyurethane, Plastisol, Emulsion, Butyl, Polysulfide), Application, Region - Global Forecast to 2024
## 10. APPENDIX B – DEFINITIONS OF IPC CLASSES

<table>
<thead>
<tr>
<th>IPC Subclass</th>
<th>Definition</th>
</tr>
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<tr>
<td>B32B</td>
<td>LAYERED PRODUCTS, I.E. PRODUCTS BUILT-UP OF STRATA OF FLAT OR NON-FLAT, E.G. CELLULAR OR HONEYCOMB, FORM</td>
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<tr>
<td>B60C</td>
<td>VEHICLE TYRES</td>
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<tr>
<td>C08J</td>
<td>WORKING-UP; GENERAL PROCESSES OF COMPOUNDING</td>
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<tr>
<td>C08F</td>
<td>MACROMOLECULAR COMPOUNDS OBTAINED BY REACTIONS ONLY INVOLVING CARBON-TO-CARBON UNSATURATED BONDS</td>
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<tr>
<td>C08K</td>
<td>USE OF INORGANIC OR NON-MACROMOLECULAR ORGANIC SUBSTANCES AS COMPOUNDING INGREDIENTS</td>
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<td>C09J</td>
<td>ADHESIVES; NON-MECHANICAL ASPECTS OF ADHESIVE PROCESSES IN GENERAL; ADHESIVE PROCESSES NOT PROVIDED FOR ELSEWHERE; USE OF MATERIAL AS ADHESIVES</td>
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<td>C09J 7/20</td>
<td>ADHESIVES IN THE FORM OF FILMS OR FOILS; CHARACTERISED BY THEIR CARRIERS</td>
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<td>ADHESIVES BASED ON HOMOPOLYMERS OR COPOLYMERS OF CHLOROPRENE</td>
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<td>C09J 109/00</td>
<td>ADHESIVES BASED ON HOMOPOLYMERS OR COPOLYMERS OF CONJUGATED DIENE HYDROCARBONS</td>
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<tr>
<td>C09J 107/00</td>
<td>ADHESIVES BASED ON NATURAL RUBBER; LATEX</td>
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<td>C09J 121/00</td>
<td>ADHESIVES BASED ON UNSPECIFIED RUBBERS</td>
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<td>ADHESIVES BASED ON HOMOPOLYMERS OR COPOLYMERS OF UNSATURATED ALIPHATIC HYDROCARBONS HAVING ONLY ONE CARBON-TO-CARBON DOUBLE BOND; ADHESIVES BASED ON DERIVATIVES OF SUCH POLYMERS; NOT MODIFIED BY CHEMICAL AFTER-TREATMENT; HOMOPOLYMERS OR COPOLYMERS OF HYDROCARBONS HAVING FOUR OR MORE CARBON ATOMS; HAVING FOUR TO NINE CARBON ATOMS; COPOLYMERS OF ISOBUTENE; BUTYL RUBBER HOMO- OR COPOLYMERS OF OTHER ISO-OLEFINES</td>
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<td>ADHESIVES BASED ON UNSPECIFIED MACROMOLECULAR COMPOUNDS</td>
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<td>C08L 53/02</td>
<td><strong>COMPOSITIONS OF BLOCK COPOLYMERS CONTAINING AT LEAST ONE SEQUENCE OF A POLYMER OBTAINED BY REACTIONS ONLY INVOLVING CARBON-TO-CARBON UNSATURATED BONDS; COMPOSITIONS OF DERIVATIVES OF SUCH POLYMERS; OF VINYL-AROMATIC MONOMERS AND CONJUGATED DIENES</strong></td>
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<td>G02B</td>
<td><strong>OPTICAL ELEMENTS, SYSTEMS, OR APPARATUS</strong></td>
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