Crumb Rubber Production

By

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Presentation Outline

- Ambient Production Method
- Cryogenic Production Method
- Technical Aspects
Cross Section Of a Passenger Tire
Effect of Rubber Processing Method on Particle Shape

Buffings - Hair - Like or Stranded Materials, Elastic Recovery 21%

Ambiently Ground Rubber With Torn Edges, Elastic Recovery 35%

Cryo Ground Rubber With Sharp Angular Edges, Elastic Recovery 6%
CRM Ambient Production Method

1. Shredding Department
2. Granulation Department
3. Grinding Department
Shredding Department
Whole Tire Shredded Down to 2 Inch Chips
Granulation Department
Primary Granulation 2 Inch Chips Being Reduced to ¾ Inch While Separating Steel
Secondary Granulation ¾ Inch Being Reduced to 3/8 Inch While Separating Fabric and Steel
Fine Grinding and Sizing
Finish Product and Bagging
Air Control System
Cryogenic Crumb Rubber Manufacturing
Processing Steps

1. Shredding
2. Granulation
3. Cryogenic Crumb Rubber Production
4. Fiber and Wire Separation
5. Drying, Classification & Bagging
Cryogenic Production Line
Cryogenic Crumb Rubber Production

- The free wire tire granulate (1 inch nominal) is fed into a 53-foot long freezing chamber.
- The freezing chamber is rotating with a slow speed to reduce tire granulate temperature from ambient to glass transition temperature of -180 °C (-290 °F).
- The liquid nitrogen is injected from a 13,000 gal tank into the freezing chamber.
- The frozen tire granulates are discharged from the end of the freezing tunnel by gravity into the three hammer mills.
- The capacity for this department is 9,000 pounds per hour.
The cryogenically produced crumb rubber passes through a screen at the bottom of each mill and is transferred to the primary screen.

- The liberated fiber are collected by a vacuum system.
- The liberated wire are separated by magnetic devices.
- The clean cryogenically produced crumb rubber are transferred to the drying chamber.
The cryogenically produced crumb rubber is introduced into the rotating dryer which produces 99.9 percent moisture free crumb rubber.

The dried crumb rubber is transferred to a four stage shaker screener to produce four different size of products.

Each product is transferred pneumatically to bagging station.

The four different product sizes are as follows:
- Cryogenic Crumb Rubber No. 10 mesh plus
- Cryogenic Crumb Rubber No. 10-14 mesh
- Cryogenic Crumb Rubber No. 14-30 mesh
- Cryogenic Crumb Rubber No. 30 mesh minus

The products are bagged in 2,000 pounds weather proof super sacks.
Technical Aspects
Crumb Rubber Modified (CRM) Specification

Section 203-11.2.3 page 99

- CRM shall be Ground or Granulated at ambient temperature
- CRM shall not contain more than 0.01% wire by weight
- CRM shall not contain more than 0.05% Fabric by weight
Scrap Tire To High Natural Rubber CRM Ratio

- 75% scrap tire CRM
- 25% high natural rubber CRM
### Grading Requirements For CRM

<table>
<thead>
<tr>
<th>Sieve Size</th>
<th>Scrap Tire CRM Passing (%)</th>
<th>High Natural CRM Passing (%)</th>
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<tbody>
<tr>
<td>No. 8</td>
<td>100</td>
<td>100</td>
</tr>
<tr>
<td>No. 10</td>
<td>98 – 100</td>
<td>100</td>
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<td>No. 16</td>
<td>45 – 75</td>
<td>95 – 100</td>
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<td>No. 30</td>
<td>2 – 20</td>
<td>35 – 85</td>
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<td>No. 50</td>
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<td>0 – 2</td>
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<td>No. 200</td>
<td>___</td>
<td>0 – 1</td>
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**Chemical Requirement For High Natural Rubber CRM**

<table>
<thead>
<tr>
<th>Test</th>
<th>Minimum</th>
<th>Maximum</th>
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<tbody>
<tr>
<td>Acetone Extract</td>
<td>4.0 %</td>
<td>16.0 %</td>
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<tr>
<td>Rubber Hydro Carbons</td>
<td>50.0%</td>
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<tr>
<td>Natural Rubber Content</td>
<td>40.0 %</td>
<td>48.0 %</td>
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</table>
Number Of Waste Tires Recycled in One Mile of Asphalt Rubber Road

✓ 3 Waste Tire (PTE) per ton of ARHM
✓ 4000 PTE per one mile road
✓ Currently over 6 million tires are recycled in asphalt application annually
Extraction Of Crumb Rubber
From Asphalt Binder
Recovered Crumb Rubber

80

20
Crumb Rubber Gradation Analysis Method
Effect of Crumb Rubber on Pavement Compaction
Effect of Crumb Rubber Quality on Finished Pavement Surfaces
Inspection of Asphalt Rubber
Surface Prior Compaction
Every Mile of Asphalt Rubber Road Recycles 4,000 Waste Tires