Introduction of EPDM, NBR and CR
China Market Overview

Mary Xu
Executive Deputy-Secretary-General from
the China Rubber Industry Association

Shanghai, September 6, 2012
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## I. SR Supply and Demand in 2010

<table>
<thead>
<tr>
<th></th>
<th>Capacity (10,000 tons)</th>
<th>Output (10,000 tons)</th>
<th>Consumption (10,000 tons)</th>
</tr>
</thead>
<tbody>
<tr>
<td>National total</td>
<td>282</td>
<td>241</td>
<td>355</td>
</tr>
<tr>
<td>SBR</td>
<td>107</td>
<td>94</td>
<td>117</td>
</tr>
<tr>
<td>BR</td>
<td>66</td>
<td>65</td>
<td>88</td>
</tr>
<tr>
<td>NBR</td>
<td>10</td>
<td>8</td>
<td>18</td>
</tr>
<tr>
<td>CR</td>
<td>8</td>
<td>4</td>
<td>6</td>
</tr>
<tr>
<td>EPR</td>
<td>2</td>
<td>2</td>
<td>22</td>
</tr>
<tr>
<td>IIR</td>
<td>10</td>
<td>4</td>
<td>28</td>
</tr>
<tr>
<td>IR</td>
<td>5</td>
<td>0</td>
<td>7</td>
</tr>
<tr>
<td>SBS</td>
<td>75</td>
<td>63</td>
<td>69</td>
</tr>
</tbody>
</table>
II. Capacity and Demand Forecast by 2015 (Unit: 10,000 tons)

<table>
<thead>
<tr>
<th></th>
<th>Capacity in 2015</th>
<th>Demand in 2015</th>
</tr>
</thead>
<tbody>
<tr>
<td>Styrene butadiene rubber</td>
<td>138.7</td>
<td>137</td>
</tr>
<tr>
<td>Polybutadiene rubber</td>
<td>80.4</td>
<td>106</td>
</tr>
<tr>
<td>SBS</td>
<td>93</td>
<td>75</td>
</tr>
<tr>
<td>Butyl rubber</td>
<td>33.5</td>
<td>38</td>
</tr>
<tr>
<td>Nitrile rubber</td>
<td>17.3</td>
<td>26</td>
</tr>
<tr>
<td>Chloroprene rubber</td>
<td>8.3</td>
<td>7</td>
</tr>
<tr>
<td>Ethylene-propylene rubber</td>
<td>25</td>
<td>35</td>
</tr>
<tr>
<td>Isoprene rubber</td>
<td>56.5</td>
<td>45</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>434.7</strong></td>
<td><strong>464</strong></td>
</tr>
</tbody>
</table>
III. Main Applications in Automotive

Tyres, 60%; non-tyres, 40%. Except for tyres, a vehicle needs 100-200 types of / or 200-500 rubber components with total weight of more than 50kg. Consumption of rubber material, approximately 50% of the total mass of the automobile. Cost of rubber components is about 6% of the total.

- Shock absorption → NBR or Butyl rubber
- Fatigue resistance → NR
- Thermal resistance → SBR
- Oil resistance → NBR
- V-belts → CR or HNBR (in China, mainly CR)
- High Temp resistance (ex: exhaust pipe) → EPDM
- Fuel hose: Past developments:
  Inner → from NBR to FKM; outer → from CR to CSM to ECO
IV. Application of EPDM in Automotive

Properties:
Excellent elasticity, wear resistance, heat resistance, weather resistance, ozone resistance, fresh water & seawater resistance

Extensive application in automotive:
1. Weatherstrip
2. Hydraulic braking hoses and seal rings
3. HVAC hoses
4. Sealing components in engine cooling aircon system
5. Coolant transfer hoses.
6. Shock absorber, Dust proof cover and tire sidewall
V. Current applications of EPDM

EPDM market/industry segmentation
- Automotive segment ➔ Highest consumption
- Polymer modification ➔ Fastest development rate

2010 China’s EPDM consumption:
- In Automobile industry = approximately 44.87%
- Water-proofing material = approximately 9.4%
- Wire & Cable = approximately 7.69%
- Oil additive = approximately 9.83%
- Polymer modification = approximately 11.97%
- Tartan track = approximately 9.83%
- Others = approximately 6.41%

According to the international normal algorithm for automobile sealing strip, the consumption per vehicle is 40m in length
VI. Application of EPDM in Water-proofing material

Companies producing water-proofing material:
• Changshu Sanheng Construction Material Co., Ltd.
• Shanghai Changning Rubber Product Works
• Beijing Carllyle Corporation
• Shanghai Tunneling Corporation

Currently the demand in China for EPDM waterproofing material exceeds 10 million square meters

Most are imported high-end products
The consumption of EPDM in this field was;
• 2005 = 9000 tons
• 2010 = 22,000 tons
• 2015 = 35,000 tons [forecast]
VII. Application of EPDM in other fields

<table>
<thead>
<tr>
<th></th>
<th>2005 (tons)</th>
<th>2010 (tons)</th>
<th>2015 (tons) [forecast]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oil Additive</td>
<td>10,000</td>
<td>23,000</td>
<td>35,000</td>
</tr>
<tr>
<td>Wire &amp; Cable</td>
<td>8,000</td>
<td>18,000</td>
<td>25,000</td>
</tr>
<tr>
<td>Polymer modification</td>
<td>11,000</td>
<td>28,000</td>
<td>40,000</td>
</tr>
<tr>
<td>Tartan track</td>
<td>11,000</td>
<td>23,000</td>
<td>30,000</td>
</tr>
</tbody>
</table>

- It is predicted that the total demand of EPDM will reach 350,000 tons in 2015.
- The annual consumption increment in 2010-2015 will grow 8.4%.
VIII. Newly built or proposed EPDM plants

- On June 12th 2012, Shandong Tianhong Chemical Co., Ltd. in Dongying Economic Development Zone proposed a 90,000 tons facility.
- On May 29th 2012, Mitsui Chemical Corporation of Japan and PetroChina announced to build a 75,000T/A EPDM project in Shanghai Chemical Industry Park.
- The Phase-II 25000T/A EPDM facility of Jilin Petrochemical was built and put into production at the end of 2011.
- Union Petroleum Group of USA plans to build a set of 40000T/A EPDM facility in Ningbo, Zhejiang.
- In Nanjing Chemical Industry Park, an 50,000T/A EPDM facility is planned.
- In Beijing Petrochemical New Material Scientific & Technological Industry Base, an 80,000T/A EPDM facility is proposed.
- Shandong Yuhuang Chemical Industry proposes building a 50,000T/A EPDM facility.
- Yanchang Petroleum Group plans to build a 60000T/A EPDM facility.
- It is predicted that, by 2015, the total production capacity of EPDM in our country will exceed 250000 tons.
IX. Opportunities and Challenges of EPDM in China 1/2

Opportunities:

• V-belts of automobile are normally made of CR with excellent comprehensive performances. In recent years, it has started to be produced with EPDM

• As main poly V-belt main rubber material, EPDM can be used to withstand high temperature of 150-170°C

• Currently automobile industry field has the largest EPDM consumption. However, over the recent years, the increment in polymer modification field is the fastest
IX. Opportunities and Challenges of EPDM in China 2/2

Challenges:

• How to adapt to the Green environment-friendly requirements for automobile components
• New requirements of automobile industry for sealing strips, e.g. color sealing strip appearing in the recent years
• The continuous development and application of other new thermoplastic elastomers such as TPO and TPV in automobile sealing strips. With both the excellent features of elastomer and excellent engineering performances of plastic, these materials are substituting for EPDM gradually
• The quality-and-cheap olefin type thermoplastic elastomers, e.g. POE, substitute part of the application share of EPDM products

Because of the inherent advantages of chain drive, such as high power, maintenance-free, heat resistance and oil resistance, there has been a tendency to use chain for timing drive mechanism of automotive engine over the recent years. In addition, because of the remarkable increment of the service life of EPDM poly V-belt, the replacement cycle becomes longer and the relative market demand will decrease

In new-energy automotive, e.g. electric car and hybrid car, belts are not used or seldom used
X. CR consumption status and development prospect

• CR is a relatively special and small assortment in synthetic rubber, and is the earliest synthetic rubber elastomer that realizes industrial production. It has overall features such as weather resistance, burning resistance, ozone resistance, heat resistance, coldness resistance, oil resistance, flexure resistance, outstanding crystalline cohesion and high strength. It can be used in severe and rugged environment, with very long product life. Currently no elastomer can substitute it completely

• The adhesive used for Footwear manufacturing and Construction fields are the largest application field of CR in China, using 60% of the total consumption. The second is industrial rubber product, using 30% of the total consumption. The rest 10% is used in Wire & Cable and other fields

• Over the years, the variation of CR consumption in our country is generally not large. In 2006-2011, the annual mean increment rate reduced by 3%. It is predicted that, by 2015, the total consumption of CR in our country will be only around 70000-75000 tons
XI. CR production and applications

• Because of the temperature rise under the engine hood, CR is being substituted by the products resistant to high temperature. The increasingly strict environmental protection regulation also requires using water soluble adhesives instead of solvent based adhesives.

• By 2008, main CR production companies in China includes; Chloroprene Rubber Corporation of Chongqing Changshou Chemical Industry Co., Ltd.; Shanxi Synthetic Rubber Corporation; Shandong Laizhou Kangbaili Rubber Industry Corporation; Chongqing Changshou has 30000 tons; Shanxi Synthetic Rubber Corporation has capacity of 25000 tons in Datong of Shanxi and 30000 tons in Yanggao County; Shandong Laizhou Kangbaili Rubber Industry Corporation has 12000 tons.

• The widest application of chloroprene rubber in China lies in shoemaking and producing architectural adhesive, which accounts for approximately 60% of all. Next to it is the use in technical rubber goods, 30% of the total consumption. Besides, another 10% of chloroprene rubber is used in wire and cable and other fields.

• Currently there are only 4-5 main assortments of CR produced in China, supplying only the domestic low- & middle-level customers.
XII. NBR production

• On June 28th, 2012, the 60,000T/A NBR project constructed jointly by Jiangsu Jinpu Group and KUO Group of Mexico was started officially in Nanjing Chemical Industry Zone. With total investment of US$110 million dollars, the project will be constructed in 2 phases. Phase I is 30,000T/A, with investment of approximately US$60 million dollars.

• The joint venture established by SIBUR Corporation of Russia and PetroChina in Shanghai has NBR production capacity of 50,000 T/A.

• PetroChina Lanzhou Petrochemical Corporation built a 50,000 T/A plant in 2009.

• Lanxing Petrochemical Tianjin Corporation of China has a 40,000T/A facility.

• Zhejiang Ningbo Shunze has a 50,000 T/A NBR plant.

• Shenhua Chemical Industry has a 30,000 T/A plant.
### XIII. Change of types of Rubber used in Automotive rubber hoses

<table>
<thead>
<tr>
<th>Rubber hose</th>
<th>Max. service temperature</th>
<th>Original rubber type used</th>
<th>Rubber type change</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fuel hose</td>
<td>120</td>
<td>Inner layer NBR</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Outer layer CR</td>
<td>FKM, CSM, ECO</td>
</tr>
<tr>
<td>Flow control</td>
<td>170</td>
<td>Inner layer NBR</td>
<td>EPDM, ECO, ACM</td>
</tr>
<tr>
<td>rubber hose</td>
<td></td>
<td>Outer layer CR</td>
<td>FKM, EPDM, ECO</td>
</tr>
<tr>
<td>Oil hose</td>
<td>180</td>
<td>Inner layer NBR</td>
<td>ACM</td>
</tr>
<tr>
<td>Radiator hose</td>
<td>120</td>
<td>SBR</td>
<td>EPDM, CR</td>
</tr>
</tbody>
</table>
XIV. Main domestic companies producing Rubber Braking parts

- Anhui Zhongding Sealing Element Co., Ltd.
- Ninghai Jianxin Rubber & Plastic Co., Ltd.
- Shanghai Hengsheng Automotive Component Co., Ltd.
- Shiyan Donbgsen Automotive Sealing Parts Co., Ltd.
- Donghai Rubber & Plastic (Tianjin) Co., Ltd.
- Ninghai County Xinhua Rubber & Plastic Co., Ltd.
- Guiyang Jingyi Rubber & Plastic Component Works
- Ningbo Fengmao Yuandong Rubber Co., Ltd.

The sales of the above companies make up about 40% of the total demand in car auxiliary market in China
XV. Companies with Oil seal production capacity of over 30 million pieces

- Wuxi Enfu Oil Seal Co., Ltd.
- Changchun Enfu Oil Seal Co., Ltd.
- SKF Sealing System (Wuhu) Co., Ltd.
- Anhui Zhongding Sealing Component Co., Ltd.
- Shaanxi Fenghang Rubber & Plastic Sealing Component Co., Ltd.
- Qingdao Kaishi Sealing Industry Co., Ltd.
- Chongqing Duke High-pressure Sealing Component Co., Ltd.
- Guangzhou Shida Group Aolisi Oil Seal Co., Ltd.
- Zhejiang Oufu Sealing Component Co., Ltd.
XVI. Companies with Sealing profiles production capacity of over 10 million meters

• Shenya Sealing Component Co., Ltd.
• Guihang Share Hongyang Sealing Component Co., Ltd.
• Tianjin Xingguang Rubber & Plastic Co., Ltd.
• Beijing Wanyuan Sealing Component Corporation
• Chongqing Yifeng Sealing Component Corporation
• Hebei Xinhua Rubber Sealing Component Corporation
XVII. Main companies producing Shock absorption rubber components

- Anhui Zhongding Sealing Component Co., Ltd.
- Wuxi Quelaibao Shock Absorber Co., Ltd.
- Nongbo Tuopu Rubber & Plastic Industry Co., Ltd.
- Donghai Rubber & Plastic (Tianjin) Co., Ltd.
- Shandong Meichen Scientific & Technological Co., Ltd.
- Shiyan Dongshen Automotive Sealing Component Co., Ltd.
XVIII. Main rubber Seal ring producers

• Anhui Zhongding Sealing Component Co., Ltd.
• Wenzhou Sanhuan Rubber & Plastic Product Co., Ltd.
• Zaoqiang County Youlian Rubber Chemical Industry Co., Ltd.
• Wuxi Meifeng Rubber Product Co., Ltd.
• Qingdao Hailiwei Sealing Co., Ltd.
• Shanghai Huaxiang Rubber Product Co., Ltd.
• Dalian Fulida Rubber Product Co., Ltd.
• Zhangjaikou Xinshiji Rubber Product Co., Ltd.
• Guizhou Dazhong Rubber Co., Ltd.
• Jihua 3517 Rubber Product Co., Ltd.
XIX. Producers of Automotive rubber hoses

- Sichuan Chuanhuan
- Ningbo Fengmao
- Tianjin Pengling Stock
- Meichen Scientific & Technological
- Shanghai Shangxiang
- Nanjing 7425
- Kuodan – Lingyun Automobile Hose Co., Ltd.
- Guenzhi Engineering Rubber Co., Ltd.

As counted on the basis of the mean utilization of 20m of various hoses in each automobile, the length of the rubber hoses demanded can be calculated. The increment of automobile maintenance market is usually calculated as 5% of the total automobile yield of the year.
XX. Problems existing in synthetic rubber in China

1. Product grades development is slow, especially the grades of oil-filled carbon black products are few. This is unfavorable for the upgrading and regulation of the product structure of the downstream users.

2. It is suggested that the development, research and application of new high-performance product technologies such as HNBR and EPDM rubber, the development of synthetic rubber modification and mixing technologies, and the development and application of green products and additive should be intensified.

3. NBR rubber will develop continuously to high performance. The representative NBR product is high-saturation HNBR, NBR with narrow relative molecular weight distribution with oil resistance and Low temp resistance balanced better, NBR with low non-rubber content, liquid carboxyl NBR and carboxyl powder NBR.

4. For EPDM rubber, more attention should be paid to Low-viscosity grades for lubrication oil modifier and the R&D of special grades prepared through chemical modifications such as ionization, grafting, halogenation, epoxidation and functional grouping.
Thank you!