EPDM RUBBER AND IT’S BENEFITS

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ABOUT IRMRA

- **Established in 1958**, as a small scale R&D Institute, is now an internationally well known Centre of Excellence both for non-tyre & tyre sectors.

- At present, IRMRA is under jurisdiction of Dept. of Industrial Policy & Promotion, Ministry of Commerce & Industry, Govt. of India, New Delhi.

- In the last 60 years, with the help of state-of-the-art facilities created with the financial assistance granted by Ministry of Commerce & Industry, Govt. of India and expertise developed by the scientists of IRMRA, it has rendered remarkable service to rubber Industries.
OUR SERVICES

▪ Testing of rubber and allied materials
▪ Training and Manpower Development
▪ Third Party Inspection Services
▪ Research and Development
WHAT IS RUBBER?

- Rubber is long chain polymer with molecular weight in the range of $10^6 - 10^7$
- Rubber chains remain in a coiled state
- Rubber molecules can stretch up to 1000% elongation by uncoiling of the chains
- Rubber as a material is highly amorphous in nature.
- Rubber molecules always remain under Brownian motion at room temperature.
- Rubber is inherently soft and weak in nature.
- Primarily comprises of carbon and hydrogen with few exceptions.

The single most important property of rubbers is their ability to undergo large elastic deformations, that is, to stretch and return to their original shape in a reversible way.
TYPES OF RUBBER

Rubber can be broadly classified into natural and synthetic rubber.

**Natural Rubber**: Derived from the plant *Hevea Brasiliensis* and is the first and most commonly used rubber.

**Synthetic Rubber**: To cater to the demanding rise of rubber in numerous applications, synthetic rubber was invented. There are various class of synthetic rubber to meet different application requirements.

- Styrene butadiene rubber (SBR)
- Ethylene propylene diene rubber (EPDM)
- Butyl rubber (IIR)
- Silicone Rubber (VMQ)
- Polychloroprene rubber (CR)
- Polybutadiene rubber (BR)
- Fluorocarbon rubber (FKM)
- Acrylo nitrile butadiene rubber (NBR)
EPDM RUBBER

• EPDM rubber is a copolymer of ethylene, propylene and diene monomer.
• It is a hydrocarbon rubber with saturated backbone.
• Dienes used in the manufacture of EPDM rubbers are
  – Dicyclopentadiene (DCPD)
  – Ethylidene Norbornene (ENB)
  – 1,4 Hexadiene
• The most commonly used is ENB at 2 to 5 %
• The properties depend on the ethylene propylene ratio, higher ethylene content provides better green strength and higher propylene content imparts better low temperature properties.
PROPERTIES OF EPDM RUBBER

EPDM rubber exhibits superiority to diene rubber in number of respects.

- Excellent resistance to oxidation and ozone attack
- Very good heat aging resistance
- Excellent electrical insulation characteristics
- Very good chemical resistance (alkalies and dilute acids)
- Good resistance to ketones and other polar solvents
- Good mechanical properties when reinforced with carbon black
- Good to excellent abrasion resistance and good tear resistance
- They perform well upto 125°C in continuous usage and can be used upto 150°C with suitable compounding.
- Very low specific gravity (0.86) makes the compound economical
- Like other diene rubber they swell in hydrocarbon
EPDM RUBBER

- The third monomer DIENE is introduced for sulfur vulcanization
- The commercial grades vary principally on:
  - The ethylene to propylene ratio
  - The type and amount of third monomer
  - Molecular weight and molecular weight distribution
  - Microstructure
  - Nature of other additives like oil, stabilizers etc.
- For optimum rubberiness and low temperature flexibility the ethylene content should be 50 – 60%
PROCESSING AND COMPOUNDING

• Does not need mastication unlike natural rubber
• Flow properties can be controlled by selecting a suitable grade with specific molecular weight.
• EPM/EPDM being saturated in nature are usually cured by peroxides.
• It is a general practice to use a coagent like tri acrylic cyanurates for peroxide curing.
• Peroxide cured EPM/EPDM has a number of advantages like higher temperature resistance, lower compression set, improved electrical insulation, non staining behaviour and ability to reduce migration.
• EPDM can also be cured by Sulfur which requires a powerful synergistic accelerator system to cope with the low level of unsaturation in the rubber.
• Carbon black is commonly used reinforcing filler. Clays and silicas are used for electrical insulation application.
• Paraffinic Oil is most commonly used as plasticizer or processing aid
It has inherently good aging properties, antioxidant may not be required in many applications.

To achieve further improvement the commonly used antioxidants are polymerized dihydroquinoline in conjunction with zinc oxide, mercaptobenzimidazole.

The best UV protection is achieved by carbon black in black compounds and Rutile titanium dioxide in non–black compounds.

It can be blended with polypropylene to produce a new class of material known as thermoplastic elastomer.

EPDM based thermoplastic elastomers have found application in many molded automotive components.
APPLICATIONS

• The largest use of EPDM is in automotive industry where it can be used in diverse applications which do not involve direct contact with fuels and lubricating oil.
• It can also be used as a supplementary elastomer for tire sidewalls to improve ozone resistance and in butyl rubber based inner tubes to reduce cold flow and improve green strength.
• It is widely used in cable insulation.
• It is also used in door and window seals and water proofing sheets.
• It is used in gaskets in appliances.
THANK YOU