

EPDM 中文名：三元乙丙橡胶

三元乙丙是乙烯、丙烯和非共轭二烯烃的三元共聚物，是乙丙橡胶的一种，以 EPDM (Ethylene Propylene Diene Monomer) 表示，因其主链是由化学稳定的饱和烃组成，只在侧链中含有不饱和双键，三元乙丙的主要聚合物链是完全饱和的。这个特性使得三元乙丙可以抵抗热，光，氧气，尤其是臭氧，故其耐臭氧、耐热、耐候等耐老化性能优异。

在三元乙丙生产过程中，通过改变三单体的数量，乙烯丙烯比，分子量及其分布以及硫化的方法可以调整其特性。

EPDM (Ethylene Propylene Diene Monomer) is a kind of ternary polymer copolymerized by ethylene, propylene and unconjugated diene terpolymer. Its main chain is composed of saturated hydrocarbon with chemical stability. There exists unsaturated double bond only in side chain. Therefore, fully saturated polymer chain offer EPDM resistance to sunlight, heat, oxygen, ozone. EPDM has excellent ozone, heat, weather and aging resistance.

During producing EPDM, properties can be adjusted by changing the quantity of ternary-monomer, the proportion of ethylene and propylene, molecular weight and its distribution, and vulcanizing method.

EPDM 最主要的特性就是其优越的耐氧化、抗臭氧和抗侵蚀的能力。由于三元乙丙橡胶属于聚烯烃家族，它具有极好的硫化特性。在所有橡胶当中，EPDM 具有最低的比重。它能吸收大量的填料和油而影响特性不大。因此可以制作成本低廉的橡胶化合物。

Main features of EPDM material are excellent anti-oxidation, anti-ozone and anti-erosion. EPDM rubber is classified into polyolefin family, so it has excellent curing properties. Among all rubbers, EPDM has the lowest density. Therefore, EPDM can absorb a large quantity of fillings and oils meanwhile has little influence on properties, which can be used to manufacture low-cost rubber compounds.

硫化类型：

三元乙丙可以利用有机过氧化物或者硫来进行硫化。但是，相比与硫磺硫化，过氧化物交链的三元乙丙用于电线电缆工业时具有更高的温度抗性，更低的压缩形变以及改进的硫化特性。过氧化物硫化的不好的地方就在于更高的成本。

Vulcanization System:

EPDM can be vulcanized by organic peroxide or sulfur. Compared with sulfur vulcanization, EPDM with peroxide cross-linking has higher temperature resistance, lower compression set and improved curing characteristics when it is applied in wire & cable industry, while the disadvantage of peroxide vulcanization is the higher cost.

硫化体系对 EPDM 性能的影响，过氧化物硫化体系形成的是短的 C-C 交联键，这种短的交联键尽管化学稳定性很好，但是运动性差，影响了抗撕裂性能。

硫磺硫化体系硫化后在胶料中生成含一个或多个硫原子的化学键，使胶料具有较高抗撕裂强度，但硫化化学键的化学稳定性和耐热性都比较差。

因此，为了使胶料在较高撕裂强度下，又具有良好的综合性能，我们采用了硫磺与过氧化物复合的硫化体系，以便在胶料中形成含硫交联键和 C-C 交联键等多种不同类型的化学键，使得硫化胶具有较高的拉伸强度、抗撕裂强度和耐疲劳性能。

Three vulcanization systems:

1) Peroxide vulcanization system: Peroxide curing can form C-C cross links, which result in good chemical stability while mobility is poor. Therefore, tear resistance is also poor.

2) Sulfur vulcanization system: Sulfur curing can form one or more sulfur atoms, which provide EPDM material with higher tear strength. However, Chemical stability and heat resistance are poor.

3) Compound vulcanization system with peroxide and sulfur: Compound vulcanization system forms sulfur-containing cross links, C-C cross links and other kinds of cross links, which provide EPDM material with higher tear strength and better comprehensive performance. Therefore, EPDM has high tensile strength, tear strength and fatigue resistance.

乙丙橡胶以乙烯和丙烯为合成原料，有二元乙丙橡胶 (EPM) 和三元乙丙橡胶 (EPDM) 之分。乙丙橡胶的性能：

1. 耐臭氧老化 2. 耐天候老化 3. 耐热性 以上三种性能在通用橡胶中是最好的。

还有以下性能 4. 卓越的耐水、耐过热水及耐水蒸气性能； 5. 优秀的耐化学药品性能；（由于乙丙橡胶本身的化学稳定性和非极性、与多数化学药品不发生化学反应，与极性物质之间不相容或相容性很小，耐醇、酸、强碱、氧化剂、洗涤剂、动植物油、酮等）

EPR (ethylene propylene rubber) is synthesized by ethylene and propylene, including EPM and EPDM.

EPR's properties:

1. Ozone aging resistance
2. Weather aging resistance
3. Heat resistance

The three properties above are the best among universal rubbers.

4. Excellent resistance to water, hot water and steam
5. Excellent chemical resistance

(EPR can't react with most chemicals due to its chemical stability and non-polarity. EPR is incompatible with polar materials or its compatibility is very small, such as, resistance to alcohol, acid, strong alkaline, oxidizing agents, detergents, animal and vegetable oils, ketone, etc.

优点: EPDM 三元乙丙橡胶:

- 1) EPDM 最主要的特性就是其优越的耐氧化、抗臭氧和抗侵蚀的能力。
- 2) 由于三元乙丙橡胶属于聚烯烃家族，它具有极好的硫化特性。
- 3) 在所有橡胶当中，EPDM 具有最低的比重。它能吸收大量的填料和油而影响特性不大。因此可以制作成本低廉的橡胶化合物。
- 4) 三元乙丙的主要聚合物链是完全饱和的。这个特性使得三元乙丙可以抵抗热，光，氧气，尤其是臭氧。
- 5) 三元乙丙本质上是无极性的，对极性溶液和化学物具有抗性，吸水率低，具有良好的绝缘特性。可广泛用于汽车部件、建筑用防水材料、电线电缆护套、耐热胶管、胶带、汽车密封件等领域。

EPDM Advantages:

- 1) Main features: excellent anti-oxidation, anti-ozone and anti-erosion.
- 2) Polyolefin family: excellent vulcanization
- 3) Low density and high filling property: EPDM has the lowest density in all rubbers, which can be able to absorb a lot of fillings & oils while has little effect on EPDM properties. Therefore, EPDM usually is made into low-cost rubber compounds.
- 4) Saturated main polymer chain: resistance to heat, light, oxygen, especially ozone.
- 5) Non polarity: EPDM is non polar in nature, which offers polar solvent & chemicals resistance, low water absorption and good insulation.

Therefore, EPDM materials can be widely used various fields, like auto parts, waterproof materials for building industry, wire & cable sleeve, heat-resistant rubber tube, rubber belt, automobile sealing gasket, and so on.

优点:

三元乙丙橡胶基本上是一种饱和得高共聚物 耐热长期使用温度

可达 150 度 耐老化性能非常好、耐天候性好、电绝缘性能优良、耐化学腐蚀性、冲击弹性较好。

EPDM 材料是乙烯、丙烯以及非共轭二烯烃的三元共聚物形成的发泡材料。它有良好的耐过热水性能/电性能/弹性/粘接性等多种性能。汽车，船舶、家电、电子设备、医疗器械、健身器材、空调管道等理想的保温隔热材料

EPDM 三元乙丙橡胶： 具有很好的耐候性、耐臭氧性、耐水性以及耐化学性。可用于醇类及酮类，还可以用于高温水蒸气环境之中的密封。适用于卫浴设备、汽车散热器以及汽车刹车系统中。不建议用于食用用途或是暴露于矿物油之中。一般的使用温度范围为：-55~150℃。

Advantages:

EPDM is a saturated polymer basically and can be in long-term operation under 150℃.

have good characteristics of resistance to heat, aging, weather resistance, excellent electrical insulation properties, good chemical resistance and impact elasticity.

EPDM is a kind of foam materials copolymerized by ethylene, propylene and unconjugated diene terpolymer. It has good uperheated water resistance, electrical property, elasticity and adhesion.

EPDM is a deal thermal insulation materials for automobile, marine, household appliances, electronic equipment, medical devices, fitness devices and air-condition pipe, etc.

Working temperature range: $-55\sim 150^{\circ}\text{C}$

EPDM rubber has good resistance to weather, ozone, water, chemicals, which can be used for alcoholic & carbonylic components, sealing under high temperature steam environment, bathroom equipment, auto radiator & braking systems. However, EPDM is not recommended for food application or exposure to mineral oil.

主要缺点:

乙丙橡胶得最主要缺点是硫化速度慢 与其它不饱和橡胶并用难 自粘和互粘性都很差 和其它材料粘性能差故加工性能不好。

Main Disadvantages:

- 1) Slow Curing rate
- 2) Poor processability:

EPDM material is difficult to blend with other unsaturated rubbers. Both self-adhesion and mutual viscosity are poor, so poor bonding property with other materials results in poor processing performance.

应用:

根据乙丙橡胶得性能特点 主要应用于要求耐老化、耐水、耐腐蚀、电气绝缘几个领域 如用于轮胎的浅色胎侧、耐热运输带、电缆、电线、防腐衬里、密封垫圈、建筑防水片材、门窗密封条、家用电器配件、塑料改性等。

Applications fields:

- Aging resistance field
- Waterproof field
- Corrosion resistance field
- Electrical insulation field

Applications for specific products:

- Light-colored sidewall of tire
- Heat resistant conveyor belt
- Cable & wire
- Corrosive resistant lining
- Sealing gasket
- Waterproof sheet for building
- Sealing strip for doors and windows
- Accessories for household appliances
- Plastic modification