

# What Is Chlorinated Polyethylene (CPE)

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Chlorinated polyethylene (CPE) is a saturated polymer material, white powder in appearance, non-toxic and tasteless, with excellent weather resistance, ozone resistance, chemical resistance, aging resistance, good oil resistance, flame retardancy, and coloring properties. Good toughness (still flexible at -30?), good compatibility with other polymer materials, high decomposition temperature, decomposition produces HCl, HCl can catalyze the dechlorination reaction of CPE.

## What are the physical properties of CPE?

Chemicals

CPE is a polymer, meaning it consists of many repeating units. The repeating unit in CPE is ethylene oxide. CPE is not particularly reactive with other chemicals.

Physical Properties

CPE is a solid at room temperature and has a melting point of about 100°C (212°F). When heated to this temperature, the polymer changes from a solid-state to a liquid state. The polymer returns to its solid state when cooled down from this temperature. Its density is about 1.0 g/cm<sup>3</sup> at 25°C (77°F), which means that one cubic centimeter (cc) of this material weighs 1 gram (g). The polymer's melting point depends on its molecular weight; higher molecular weights have higher melting points.

## What are the uses of CPE?

CPE is a chemical that can be used to make many different products. It is used in the production of plastics, adhesives, and many other products. It can also be used to make fertilizers and pesticides. One of the most common uses for CPE is as a solvent in paints and coatings. This makes it possible for paints to dry more quickly and evenly, so they don't leave streaks on walls or require multiple coats to cover an area evenly.

CPEs are also used in various types of plastic manufacturing processes. Injection molding machines use CPEs as lubricants when creating new plastic parts. This prevents the machine from overheating while working on your product and working more efficiently.

CPEs are also found in many different adhesives, including those used in packaging, paper production, and construction materials such as cement blocks or bricks. They help these materials bond together to form strong bonds without being glued together manually each time they're assembled into something new.

Overview of uses: Chlorinated polyethylene resin is a new synthetic material with a series of excellent properties. It is an excellent impact modifier for PVC plastics and a synthetic rubber with good overall performance. It has a wide range of application fields. It has been widely used in cables, wires, hoses, tapes, rubber and plastic products, sealing materials, flame retardant transportation belts, waterproof rolls, films, and various profiles. CPE can be regarded as a random copolymer of ethylene, polyethylene, and 1,2-dichloroethylene, with saturated molecular chains and random distribution of polar chlorine atoms. It is widely used in machinery, electric power, chemical industry, building materials, and mining because of its excellent physical and chemical properties. Nitrile rubber (NBR), neoprene rubber (CR), aging resistance better than chlorosulfonated polyethylene (CSM); acid, alkali, salt, and other corrosive properties, non-toxic, non-flammable, no explosion risk.

Mainly used in: wire and cable (coal mine cable, UL and VDE standards for wire), hydraulic hoses, automotive hoses, adhesive tape, rubber sheet, PVC profile pipe modification, magnetic materials, ABS modification, etc.

Chlorinated Polyethylene (CPE) Application Compatibility

## Reinforcement filling system

CPE is a non-self-reinforcing rubber that needs a reinforcement system to achieve better strength. Its reinforcement filling system is similar to general rubber; the reinforcing agent is mainly carbon black and silica. Silica can improve the tear resistance of CPE and can form the inter-methacrylic system to improve the bonding of CPE and skeleton. CPE has a high filler, and the filling system mainly has

calcium carbonate, talcum powder, clay, etc.

### **Plasticizing system**

Ester plasticizers and aromatic hydrocarbon plasticizers are the most commonly used for CPE, such as dioctyl terephthalate (DOTP) and dioctyl adipate (DOA) aromatic oil, etc. Their solubility parameters are close to CM, and their compatibility is good. Dioctyl phthalate (DOP) has been discontinued due to environmental problems. DOA and DOS are used in adhesives to give them excellent cold resistance, and DOS is very suitable for situations where heat and cold resistance are required at the same time.

### **Stabilization and protection system**

CPE will be dehydrogen chloride when heated or vulcanized (non-peroxide vulcanization system), so it is necessary to use stabilizers with acid absorbing effects such as calcium stearate and barium stearate lead trisulfate or magnesium oxide in the formulation.

### **Vulcanization system of CPE**

CPE is a saturated rubber, and the general common sulfur vulcanization system can not be effective for its vulcanization.

The vulcanization system is divided into four major: 1. thiourea system, 2. peroxide system, 3. thiadiazole system, 4. triazole dimercaptoamine salt system.

First, the CPE vulcanization system is applied earlier in the thiourea system, the most effective is Na-22, but Na-22 vulcanization speed is slow, poor aging performance, a high permanent deformation in compression, and Na-22 is a serious carcinogenic substance, vulcanization produces an unpleasant odor, has been restricted in foreign countries.

Second, at this stage, the CM vulcanization system is the more mature application of the peroxide vulcanization system. Its faster vulcanization speed, good physical properties of the product, and small permanent deformation in compression. A peroxide system can be used in the production of adhesive tape. The product's physical properties are good, heat resistance and oil resistance performance. The system, with the addition of cross-linking agents such as TAIC, TAC, TMPTM, and HVA-2, can significantly improve its physical and mechanical properties and heat resistance. As peroxide is a free radical reaction to produce cross-linking, some acidic fillers will affect the generation of free radicals, so such fillers should not be used. However, peroxides are not suitable for lower pressure, moldless vulcanization, and high process requirements, so it is difficult to be used in most rubber products process.

Third, EataMix TCHC is a compound type CPE special vulcanizing agent, and the product is non-toxic. This can use cheap aromatic oil as a plasticizer and excellent vulcanization rubber performance. The activity of MgO on the TCHC system vulcanization rubber physical properties and aging performance, ultra-fine Mg(OH)<sub>2</sub> do acid absorber and iodine absorption value of 150 high activity magnesium oxide equivalent, can replace the expensive Imported high activity magnesium oxide, greatly reduce the manufacturing cost.

The application cost is much lower than the foreign thiadiazole system, and it can be applied to various vulcanization processes, including lower temperature, moldless and low-pressure vulcanization. TCHC is slower than peroxide but can be vulcanized at a lower temperature, with no pressure, mold, and excellent performance.

The Thiadiazole system mainly consists of cross-linking agents and accelerators. The main cross-linking agents are ECHO.A, ECHO, TDD, PT75, and TDDS. The main accelerators are Vanax 808, EataAccelDH, NC, Accel 903, and BF. these promising additives classes.

### **Fourth is the triazole ethionamide salt system.**

Triazole dimercaptoamine salt vulcanizing agent is the integration of thiadiazole vulcanizing agent and accelerator (n-butyl aldehyde and aniline condensate) effective group of a single substance to overcome the thiadiazole and accelerator on the rubber cross-linking, the irregular distribution of bonds shortcomings, making the rubber cross-linked body into a stable structure. Compared with the thiadiazole system, the salt also changes the pH value of the system from strongly acidic to neutral due to the introduction of special groups, which changes the adverse effect of acidic fillers on the system and makes the rubber cross-linked more chemically active.

Therefore, the CPE rubber cross-linked by this system has a qualitative improvement in physical or chemical properties. It can use aromatic oil, magnesium oxide, and magnesium hydroxide as raw materials, suitable for low temperature and low-pressure vulcanization process conditions, fast vulcanization speed, faster than thiadiazole, low addition amount (2 parts), favorable unit price, no decomposition within the vulcanization temperature, no odor, environmental protection and non-toxic.