



JP Specialties, Inc. / Earth Shield® Waterstop

***Tech Tips 024***

# **What is Thermoplastic Elastomer Rubber? TPER, TPO, and TPV?**

*by David R. Poole CSI, ACI*

25811 Jefferson Avenue  
Murrieta, CA 92562  
T 19517637077  
F 19513860160  
jpspec@jpspecialties.com  
<https://www.jpspecialties.com>

*Understanding the difference between TPER and TPV is the key to writing more robust specifications for chemical-resistant water-stop. The key is in the crosslinking of the rubber phase. Polymers are chemical compounds formed by multiple structural units called monomers.*

In the laboratory, forming polymers from monomers is called polymerization and is often so complex that it has to be initiated or sustained by heat, pressure, or a catalyst. Synthetic polymers produce plastics, synthetic fibers, and synthetic rubber.

Polymers come in different forms and have certain qualities (strength, elasticity, resistance to solvents, and temperature extremes), achieved through vulcanization, where individual polymer molecules form crosslinks.

The vulcanization of polymers leads to springy rubber molecules that can become locked together to a greater or lesser extent. These molecules form rubber or elastomers. The end material is stronger, much more durable, and more resistant to chemicals.

## **ELASTOMERS**



Elastomers are amorphous polymers, the result of crosslinking rubber molecules through vulcanization.

An elastomer can exist in two states:

- Uncured elastomers are a gelatinous mass with the consistency of chewing gum in its natural state.
- Cured elastomers (i.e., vulcanized elastomers) are rubber-like materials that stretch to twice their original length.

Thanks to their crosslinks, they return to most of their actual size when released.

25811 Jefferson Avenue  
Murrieta, CA 92562  
T 19517637077  
F 19513860160  
jpspec@jpspecialties.com  
<https://www.jpspecialties.com>

### PLASTICS

Plastic or thermoplastic polymers consist of long polymer molecules that are not linked to each other, i.e.; they have no crosslinks. They can generally go through many melt/freeze cycles without suffering chemical change.

Thermoplastics include polyethylene, polypropylene, polystyrene, polyester, polyvinyl chloride, acrylics, nylons, and polyurethanes.

Fundamental differences exist between thermoplastic polymers and thermoset rubber. Thermoset rubber generally demonstrates a better elastic behavior and a better memory than a thermoplastic material. They are also better suited to high-temperature applications. Thermoset rubber is not easily recyclable like thermoplastic, which can be melted and reshaped.

### THERMOSET RUBBER

Thermoset rubber refers to a range of elastomers that vulcanize to a more robust form through the addition of energy (heat or irradiation). The added power and catalysts cause the molecular chains to link into a rigid, 3D structure. However, once vulcanized, they cannot be melted and reshaped.

Important thermosets include phenolics, urea, melamine, epoxies, polyesters, silicones, rubbers, and polyurethanes.

### THERMOPLASTIC ELASTOMERS (TPER)

Thermoplastic elastomers (TPERs) are a diverse family of rubber-like compound materials that combine the functional performance and properties of conventional thermoset rubbers with the pro-



JP Specialties, Inc. / Earth Shield® Waterstop

cessability of plastics. TPERs permit the fabrication of rubber-like products with the ability to be reshaped or reformed with the application of heat.

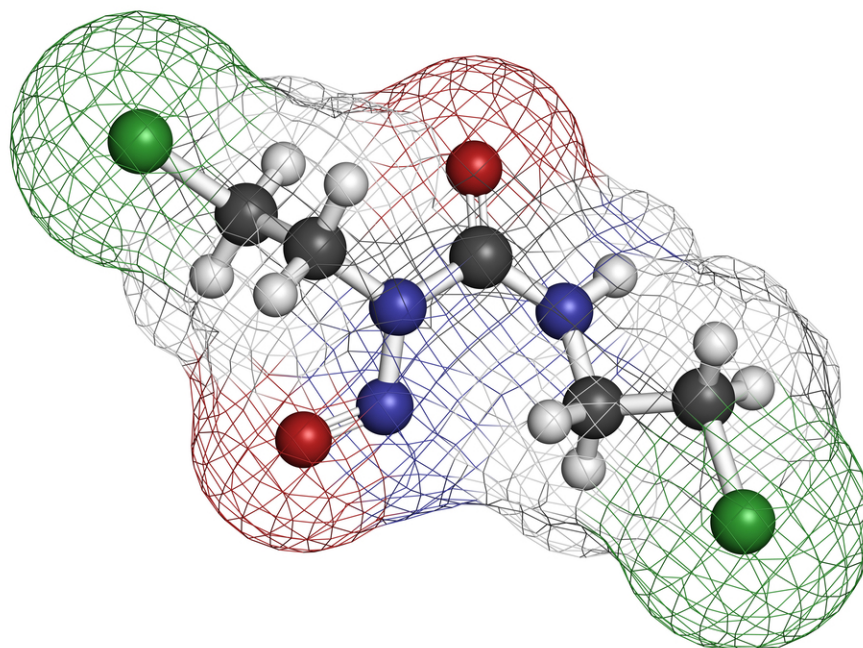
### THERMOPLASTIC VULCANIZATES (TPV)

Thermoplastic vulcanizates (TPVs) belong to the thermoplastic elastomer (TPER) family. TPVs are chemically crosslinked rubber within a thermoplastic polymer phase.

The level of vulcanization (partial versus full) has an impact on the properties of the TPV. A fully vulcanized TPV demonstrates improved performance than a partially or non-vulcanized one (thermoplastic polyolefin or TPO).

25811 Jefferson Avenue  
Murrieta, CA 92562  
T 19517637077  
F 19513860160  
jpspec@jpspecialties.com  
<https://www.jpspecialties.com>

TPVs have outstanding properties, including excellent elastic recovery, high-temperature resistance, and chemical resistance.



*A TPV molecule — Crosslinked rubber phase encased in a thermoplastic matrix.*