THERMOPLASTIC ELASTOMER (TPE) vs. LIQUID SILICONE RUBBER (LSR)

A Brief Comparison of Specific Thermoplastic and Thermoset Materials

Complex injection molding is a viable solution for many projects, but there's often confusion about which material matches the job. While "thermoplastic" and "thermoset" sound similar and both are appropriate for many applications, the material properties of these two resin categories and how they behave during processing ultimately reveal the best fit.

For a better understanding of similarities and differences, we'll compare a popular material from each category: thermoplastic elastomer (TPE) — a thermoplastic — and liquid silicone rubber (LSR) — a thermoset.

TPE	LSR
Synthetic resin that becomes plastic on heating and hardens on cooling, without changing plastic chemistry.	Synthetic resin wherein polymers are joined and structured by chemical bonds that harden permanently after one application of heat.

MOLDABILITY PROCESS

Plastic pellets are heat-liquified and pressure-molded into components that strengthen and hold shape upon curing without using a chemical bond, so molding can be reversed (reground/melted) to correct defects and the resins reused multiple times.

Viscous plastic is heated to cause polymer cross-linking, and the resulting chemical bond provides irreversible strength and shape after curing. Another common way to process LSR is to mix two components prior to injection into the mold. One component is a catalyst that initiates cross-linking.

ADVANTAGES

- Recyclability
- Less energy consumed during production
- Re-molding opportunities without chemical change
- Easier and less expensive molding process than thermoset LSR
- Shorter molding cycles
- Heat sealable
- Easily colored by most dyes
- Greater number of two-shot molding options
- Extremely tight tolerances achievable to within +/-.001"

- More resistant to high temperatures than thermoplastic elastomer (TPE)
- Design flexibility, including thick to thin wall constructions
- High tear strength
- Biocompatibility
- High chemical resistance
- Superior compression set

DISADVANTAGES

- Can melt if exposed to high temperatures after curing
- Can "creep" and cause deformation if under sustained pressure or other stress
- Tooling can be costly

- No recyclability/ regrind options
- Cannot be re-molded after curing
- May burn if heated after curing
- Lengthy curing period adds to production time and cost
- Can cause production delays as equipment must be disassembled and cleaned if early cure occurs
- Liquid state of material can make it difficult to handle
- Can be bulky or thick in appearance

COMMON APPLICATIONS

- Soft-touch grips
- Seals
- Impact resistant device and component housings
- Some food-contact approved applications like bottle cap and closure liners, baby bottles and toddler cup spouts (provided proper FDA regulatory compliance is met)
- Alternatives to latex, silicone, PVC or rubber in some medical/healthcare applications like gloves and non-invasive equipment components

- Medical implantables
- Gaskets and hardware in consumer appliances like microwaves
- Electronic interfaces on device keyboards or touchpads
- O-rings, wire harnesses, coverings, stoppers and other plastic automotive parts consistently exposed to harsh chemicals and high heat

WHAT'S NEXT

If you're not sure which materials and process are right for your molding application, reach out to Kaysun. We have the design and engineering expertise to guide your project from part design through production. We tackle even the toughest design challenges, including metal to plastic part conversion and consolidation. **CONTACT KAYSUN TODAY!**

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