

The most common means of bonding polystyrene parts to each other are solvents, adhesives and ultrasonic welding. For bonding polystyrene parts to different materials, adhesives are most effective. Choices between these three methods will be based on cost, safety, bond strength and part appearance.

Liquid solvents will readily bond polystyrene parts. For fast drying needs, methylene chloride or methyl ethyl ketone are effective. Toluene is also effective but requires longer times to evaporate. Care must be taken during application of the solvent since these chemicals can cause environmental -stress cracking on parts with applied or residual stresses. An option to control the placement of the solvent is to predissolve up to 15% by weight of the resin pellets used to produce the parts in the solvent. If different polystyrene resins are to be bonded, the lower melt flow material can be chosen to thicken the solvent. Proper safety and handling precautions should be followed when using solvents.

Adhesives can also be used to bond polystyrene parts to each other, to other polymers or non-plastic surfaces. The most common types are cyanoacrylates, acrylics and urethane based. Rubber toughened versions can also be used if desired. Surface preparation is important to achieve a good bond and the adhesive should match the coefficient of thermal expansion of the polystyrene to avoid high stresses.

Ultrasonic welding, heat staking and spin welding will effectively bond polystyrene to itself. This technique is not recommended for dissimilar thermoplastics. Generally, like resin grades will give the best results. Material factors that affect the bond include, mold release agents, lubricants (internal and external), plasticizers and rubber (HIPS). These features must be taken into consideration to ensure good bond strength.

For ultrasonic welding, resins with higher moduli can transmit the ultrasonic energy more efficiently. If different polystyrene grades are to be ultrasonically bonded, their softening points should be less than 5°C apart for the best results. Typical power supplies with output frequencies of 20-40 kHz are satisfactory. Joint design is critical with energy directors commonly used with polystyrene. A competent equipment supplier should provide technical assistance in the areas of amplitude boosters, horn geometry, joint design and part fixturing. Both near and far field can be used with polystyrene resins. Finally, ultrasonic welding process parameters that can affect the weld quality are weld time, hold time and contact pressure.