

Beahm Designs, Advanced Polymer Case Study

Thermal Bonding of Polyurethane Balloons Using Polyester (PET) Heat Shrink Tubing

How a medical device manufacturing company solved costly accuracy and repeatability problems with thermal bonding equipment.

Brief: With a little help from Beahm Designs, Advanced Polymers has developed an unbeatable method for Thermal Balloon Bonding.

How does an industry leader in design and manufacture of ultra-thin Polyester (PET) heat shrink tubing develop an accurate and repeatable method for bonding very thin-walled, highly elastic urethane balloons on a catheter shaft without resorting to a high cost RF die bonding process? This was the challenge faced by Mike Barbere, assembly engineering manager of Advanced Polymer Inc. (API).

“We needed to bond very thin walled, highly elastic urethane balloon necks to a catheter shaft. Adhesives worked only at very low pressures. Although we got adhesion, the necks of the balloon would stretch as the balloon grew under pressure and the peel force was just too great for the adhesive to hold the balloon neck in place. We had done thermal bonding in the past using hot air and our PET shrink tube. The resultant bonds were glass smooth and were incredibly strong, however, hot air was not easily directed and controlled. The results were that some times the balloon, which is sensitive to heat, would get distorted. It took a great deal of skill and luck to have each part come out acceptable each time”.

Background:

Advanced Polymers, Inc., a fifty person medical component supplier based in Salem, New Hampshire, was looking for a reliable fast simple method of bonding its line of polyurethane balloons. After evaluating several possible options, API selected the Split Die Thermal Bonder as an affordable alternative to RF die bonding. “We were very pleased with the reliability and innovation we’d come to associate with Beahm Designs, so when Brian Beahm, company president suggested the Split Die Thermal Bonder as a potential solution, we were glad to give it a try”.

The Split Die Thermal Bonder is used by medical device engineers and technicians to create fast, very precise, highly repeatable bonds for demanding applications such as short balloon bonds and ultra smooth lap and butt welds. The unit has adjustable clamp pressure and can vary compression force on joints. The unique and simple die head design provides a low cost quick-tool alternative to RF die bonding.

The Process

By applying the heat onto the balloon bonds through direct contact while using the cooling air to protect the balloon, API was now equipped to utilize their Polyester (PET) Heat Shrink Tubing to provide a constant compression force uniformly around the melted balloon neck and shaft materials. This compression force made the materials flow together into a single polymer structure and provided a smooth, glass-like tapered finish to the bond area.

“Once we began using the Beahm Designs Split Die Thermal Bonder and made the first jaw modifications to accommodate the balloon necks, it was a matter of one day’s worth of engineering work to establish parameters and evaluate the results. In just a few attempts we had our first bonds. They were evaluated by dissection of the bond areas and burst testing the balloons and found to be as good as our best efforts using other processes”.

The ultra thin walls of the Polyester (PET) Shrink Tubing creates rapid shrinkage and heat transfer to the parts to be fused. Because the PET shrink tube provides a uniform compression force in the radial direction and by virtue of its longitudinal shrinkage, it also provides linear compression of adjacent tubes.

API is not only able to make balloon bonds with the Beahm Designs Thermal Bonder, but has been able to make butt joints in single lumen tubes, since the machine is capable of attaching soft tip materials to catheter shafts and in the same operation tapers the ends of the tube. Again the Polyester (PET) Shrink Tube imparts an ultra smooth “glass-like” finish and can easily taper the tube to a knife-edge without the cost of high priced equipment and tooling.

Conclusion:

The combination of Beahm Designs Split Die Thermal Bonder and the use of the API Polyester (PET) Heat Shrink Tubing are unbeatable in terms of cost effectiveness, ease of use and quality. “By eliminating the waste associated with our former trial and error process, not to mention the cost of engineering time, we were able to realize immediate and significant savings. And the level of quality control with this new process lets us focus on our core competency, tubing and balloon manufacturing”.

System Specifications

Split Die Thermal Bonder

Temperature Range: ambient to 700 deg. **Standard Bond Widths:** As short as .062” and as long as 500" (custom die heads on request).

Standard Bond Diameters: Up to 1/2" standard, (larger on request).

Contact Information

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Beahm Designs, located in Campbell, California, is a global leader in supplying catheter manufacturers with premier manufacturing equipment. From custom equipment to hot air stations, Beahm Designs products provide global and nationwide customers with a low-cost method for increasing catheter productivity, repeatability and ease of use.

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Headquartered in Salem, New Hampshire, API is the industry leader in the manufacture of ultra thin, ultra strong PET heat shrink tubing. API is considered the industry standard and is used worldwide. API also manufactures high pressure angioplasty balloons and elastomeric balloons, custom catheter assemblies, and custom extruded tubing.