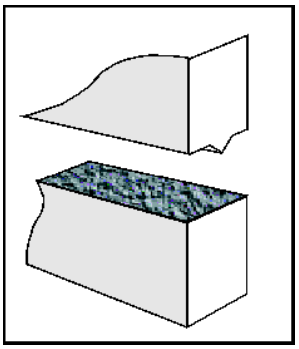
The latest advance in joint design technology is the patented use of a texture on the surface opposite the energy director.

The textured pat-terns consist of many small surface projections – 3, 4.5 or 6 mils – molded in the joint surface.

Texturing the surface provides the following benefits:

- Increases weld strength up to three times
- Reduces flash and particulate matter
- Reduces the total energy required.



This design concept is generally used in conjunction with an energy director to improve the overall weld quality and strength by controlling the melt and enhancing frictional characteristics. A closer look at the mechanics involved shows how this design detail results in substantial gains.

Without Textured Surface

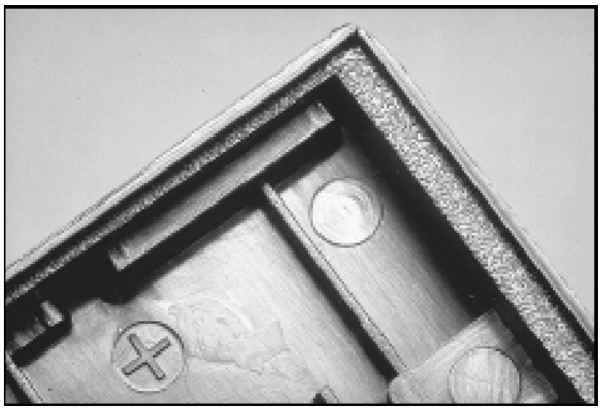
Typically, when welding a butt joint with an energy director, the apex of the energy director is placed in intimate contact with a relatively flat, smooth surface. Once the ultrasonics are initiated, the surface friction and intermolecular friction that is used to heat the surface begins. The build-up of heat due to surface friction is delayed, however, because lateral motion of the energy director is unrestricted by the smooth mating surface.

When sufficient thermal energy is generated to cause a change of the material state (solid to melt), the melt from the energy director and adj acent joint area flows freely over the smooth surface. As the melt leaves the heat zone, cooling occurs before it can mix on a molecular level with material from the opposite joint area. All of these factors can contribute to insufficient or inconsistent welding results and objectionable flash.

With Textured Surface

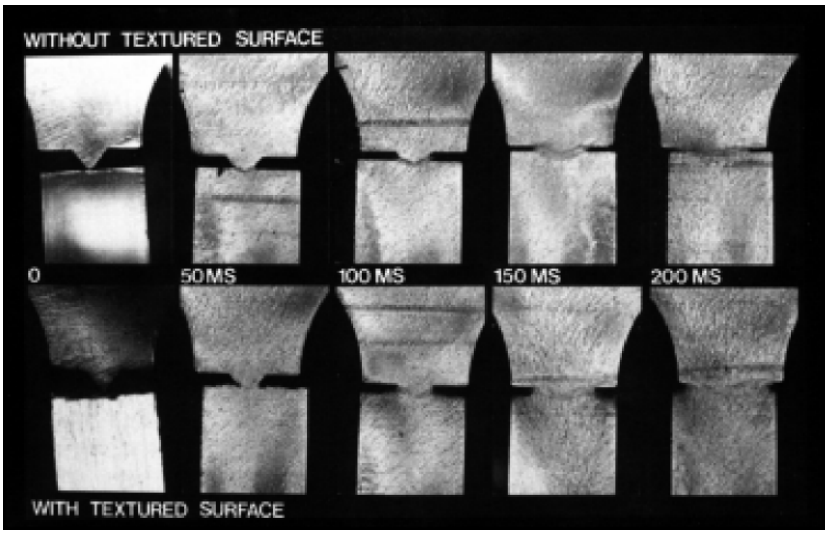
The addition of the textures surface changes the process in a number of ways. The apex of the energy director now comes in contact with a non-continuous surface of numerous small projections that act as mini energy directors.

Surface friction is enhanced by the textured surface, because the apex of the energy director is prevented from 'skating' side to side which results in faster heating.



Close-up of a typical textured surface joint.

The peaks and valleys created by the textured surface form a natural barrier that prevents the molten material from flowing out of the joint area. They help to retain heat and reduce flash and particulate matter. They also generate a greater surface area for bonding which increases joint strength.



Microstructural Analysis of Weld Sections

The series of photos above shows a comparison between the weld progression of components with and without texturing. (Material is poly Further evaluation determined that amplitude at the horn face could be reduced (a booster with a lower gain ratio was utilized) while maintaining the improved strength. This has further significance because lower amplitude levels produce lower stress in the ultrasonic components. The textured surface typically reduces total energy requirements which results in shorter weld times.

Implementing the Use of Textured Surfaces

We worked with Mold-Tech, Chicopee, MA, to develop three standard textured surface finishes. The table below lists We/MoldTech texture designations, pattern depth, and the range of energy director heights for which they are recommended.

Adding a texture to an existing part is a simple process. The injection mold is taken to one of Mold-Tech's representatives (located world-wide). A We/Mold-Tech texture designation is selected, based on the size of the energy director, and etched into the joint area of the mold.

Since a maj ority of inj ection molded parts are textured for cosmetic purposes, this could be a simple addition during mold fabrication.

A reference plaque containing the actual finish-es and recommendations for their use with vari-ous energy directors is available from We. carbonate.) A microstructure section of each component welded at 50 ms intervals is shown. Note the changes in the energy director in each case. As the energy director melts, it begins to form flash on either side. At 100 ms the energy director starts to penetrate the mat-ing textured surface, whereas only a melt has taken place on the component without the texture. At 200 ms there is a complete melt with homogeneous mixing on the textured component. The non-textured component has melted but has not thoroughly mixed with material from the opposite surface which results in a highly-stressed, low-strength joint area.

Case Study Document Improved Strength

A case study highlighting the positive effects of this technique involves a large electrical device housing. The housing was made of an injection molded grade of polycarbonate. The housing was initially designed with a tongue and groove plus energy director joint. The application required a hermetic seal able to withstand an internal pressure of approximately 50 psi.

The prototype test samples gave very poor results, i.e., inconsistencies and leakers. The solution to this problem: texture the mating surface opposite the energy director. A texture was added to the mating surface without any other changes to either the part or equipment setup. The subsequent test results far exceeded the requirements in strength and hermeticity.

We/M old- Tech Texture Designation	*Pattern Depth*	*Energy Director Height*
We 300 We 450 We 600	0.003" 0.0045" 0.006"	0.005-0.011" 0.012-0.017" 0.018" and up