MeltFlipper® MAX™ Case Study

Case Study: Influencing filling patterns and weldline strength using MeltFlipper® MAX™ technology

Any process engineer would agree that given the task of reducing or eliminating the effect of a weldline is far from effortless. Typically the part geometry or gate location would need to be altered to minimize the effects of weldlines, which include poor aesthetics and weak part strength properties...including premature part failure. The part geometry changes that would be required to solve the problem are typically not approved by the part designers or customers, so that option is usually ruled out. And the dramatic steel modifications required moving or adding gates can be quite cumbersome and expensive, and may have little to no effect on improving the weldline.

A weldline is formed when two flow fronts converge. The strength of the weldline is given by the temperature of the flow fronts and their ability to entangle the molecules with one another. Often the weldline is formed by "cooler" material, which will reduce the overall strength of the weldline (Figure 1 top). However, if the weldline can be formed with hotter material and then allowed to form a meldline (instead of a weldline), the resulting part properties and strength could be increased

In order to accomplish this, BTI tested MeltFlipper MAX technology in a single cavity A-Frame part. Prior to using MeltFlipper MAX, the weldline would render a brittle failure (Figure 1 Top). This was a result of the high sheared material flowing along the outside walls of the part, and the low sheared material would meet in the center, producing the weak weldline. However, after implementing MeltFlipper MAX, the high sheared material was strategically located in the center of the part. This allowed the hotter flow fronts to merge together and produce the desirable meldline. This meldline significantly improved the integrity of the part. The failure now was a ductile failure (Figure 1 Bottom). Tests have revealed that weldline strengths can be increased as much as 2:1.

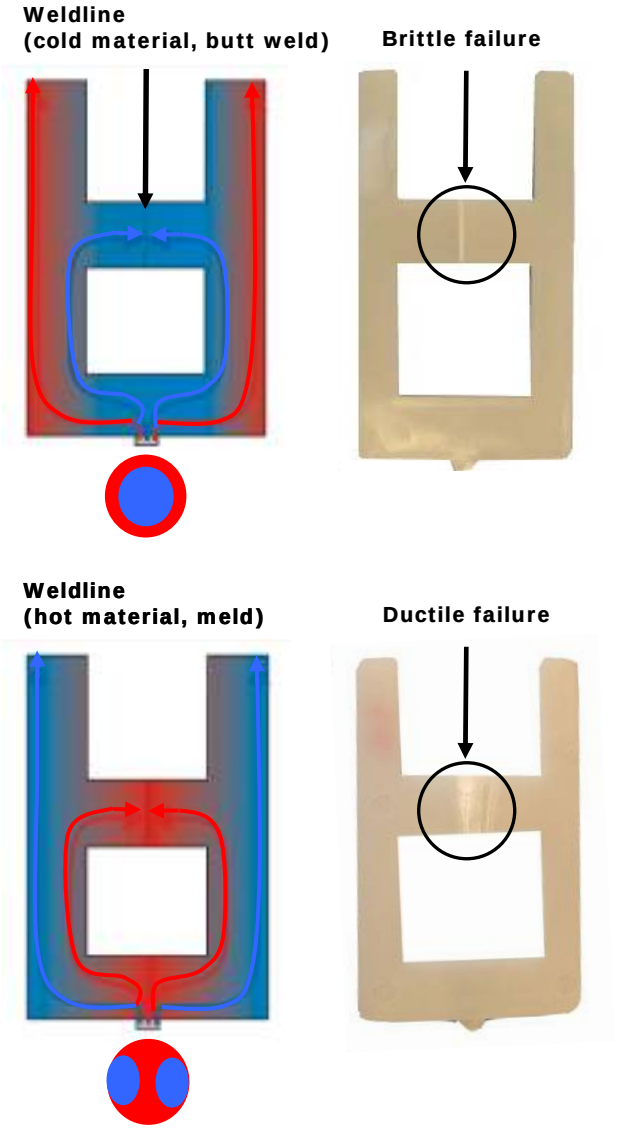

Figure 1: Top – conventional weldline formation resulting in a brittle failure. **Bottom** - meldline developed by using MeltFlipper MAX resulting in a ductile failure and increased strength.

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MeltFlipper MAX was then implemented by a BTI customer in a 2-cavity production electrical connector mold. The customer was experiencing a weldline along the wall of the nut cylinder. This issue remained unnoticed until the parts were shipped to the customer to have a threaded insert added to the part. By adding the insert into the cylinder, the hoop stress caused the parts to crack and render them useless, thus resulting in significant scrap and customer return costs (Figure 2).

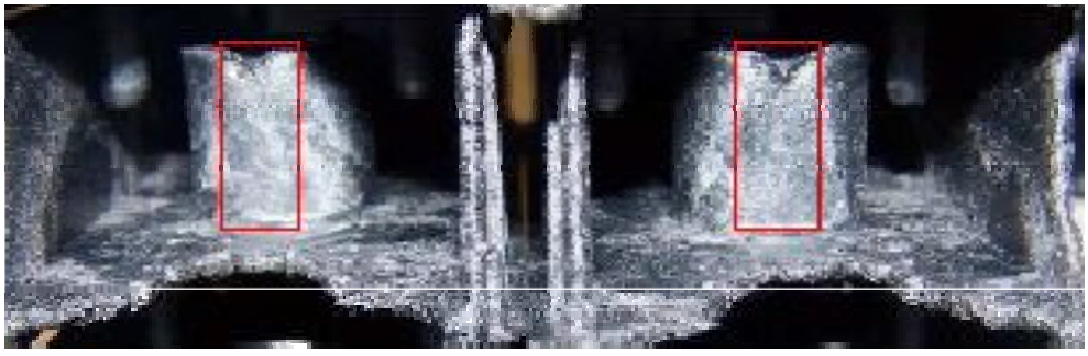
Figure 2: Assembled component with stress crack

The customer then approached BTI to evaluate the filling and offer a solution to the weldline problem. BTI proposed MeltFlipper MAX be implemented to effectively change the filling pattern by bringing the high sheared material through the center of the part where the nut cylinders were located, thus forming the weldline with hotter material in hopes of creating a meldline. After MeltFlipper MAX technology was introduced, the customer said "the weldline seemed to disappear", and the overall part strength was increased. The end result not only eliminated the weldline problem but it also eliminated the expensive customer return issue (Figure 3 Top and Bottom).

Before MeltFlipper MAX

Cavity 1 **Cavity 2**

After MeltFlipper MAX



Cavity 1 **Cavity 2**

Figure 3: Top - Severe weldline development along the nut cylinder wall.
Bottom - Weldline dramatically reduced by changing the filling pattern inside the cavity after implementing MeltFlipper MAX technology.