Over-Molding Plastic over Flex Circuits, Part 2

Picking the material and designing the mold.

It is also important to consider the CTE (coefficient thermal expansion) of both the molding material and the flexible circuit. If there is significant mismatch between the two CTE values, an increase in temperature can cause extreme internal stresses on the flex circuit, which in turn could damage the flex.

Molding procedures. Probably the most important process prior to over-molding is ensuring the flex is thoroughly dry. Flexible circuits are extremely hygroscopic, and anyone who does component assembly on flex knows how critical preconditioning is. If moisture is absorbed in a flex circuit is not baked prior to reflow, the rapid temperature ramp during solder reflow will cause the moisture to expand, causing catastrophic delamination in the circuit. The same is true with over-molding. When the hot plastic contacts the flex circuit, it will have the same effect as a reflow oven. I recommend using the same prebaking guidelines for over-molding as for SMT. Keep in mind the thicker the circuit is, the longer it will need to bake to completely drive out all moisture.

Analysis and testing. In most over-molded flex circuit assemblies, it will be nearly impossible to inspect the flex for damage after it is molded in place. The only way to inspect the final product is a destructive cross-section to look for delamination, conductor cracks, etc. But in order for a cross-section to provide meaningful results, you need to know where to perform it. Until there’s a failure, this won’t be known. In some cases, if the plastic is soft enough, you may be able to surgically remove the flex for inspection. I would recommend sacrificing a few assemblies after over-molding for cross-sectional analysis (in multiple axes) and also for possible removal of flex for inspection. In the long run, the most important aspect is the reliability of the final product. There is no good replacement for mechanical functional testing. Set up a flexing tester that mimics the bending the product will be subjected to. Cycle several pieces through what would be representative of the product life, and also cycle some to failure to see how the two values compare. As mentioned in part 1, this can be a challenging endeavor and may take a couple of tries to get the over-molding process perfected for a given application. PCD&F

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