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Cycletime Tips - General

Volume 11: Plastic Product Failure

By Bill Fierens

A good designer blends a knowledge of materials, an understanding of manufacturing processes, and imagination into successful designs. Recognizing the limits of design with traditional materials is the first step in exploring the possibilities for innovative design with relatively new materials. What is important when analyzing designs is to incorporate ergonomics and empathy, to result in a product that answers the customer's needs.

The diagram above incorporates several attributes to which an adequate material supplier should be capable of making substantial contributions. The fact is, a competent material supplier sees thousands of successful applications across the country every year - many of them similar to yours. Why not keep them involved in all facets of product development?

Understanding the ways that plastic parts can fail will go a long way toward realizing the limitations of thermoplastic design. Early into the life of any part, the designer should consider possible ways for it to fail in application. The most common modes of failure are: elastic deflection, inelastic deformation, and fracture. Parts fail during elastic deflection when the load applied produces too large an aberration. Inelastic deformation is caused by massive realignment of the molecular structure, after which the part never returns to its original shape. The presence of fracture is the result of a load applied which exceeds the strength of the design. This load may be sudden, such as at impact, or a steady load slowly applied over a period of time. This typically produces creep rupture.

There is no substitute for practical experience with respect to product design - provided a continuous loop of constructive communication is available to the designer. If the part has never been developed by your organization before, search the industry for similar products for your organization's hybrid testing. Before the product splashes down in the consumer market, different methods of part modeling can be utilized when the application warrants it. These additional investments in time and money could prevent product recalls and/or painful financial losses to you and your company.

Whenever possible, when developing injection molds for complex assemblies, mold some parts out of transparent material during the first samples. In other words, if a housing is to be made from ABS, produce a few from clear polystyrene. This will enable the designer to witness pinched wire potential, interference with bosses intended for assembly, and predicting unnecessary loads produced during assembly (birefringence testing).

In many cases, the cause of premature plastic part failure can be assigned to a weak processing method. A competent processor must document and follow a procedure for tool qualification and indicate to the engineer assigned to the tool's development how the tool falls short of his/her expectations. Ignoring sound processing techniques in order to produce aesthetically pleasing parts will result in parts lacking physical quality and disappointing production levels.

The competitive injection molding industry is quickly advancing to the point where plastics fabricators who ignore the details will suffer severely. Tapping the proper resources while in the development mode is critical. Continue to utilize technical service through all portions of this initial portion of the part's life cycle.

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