

In-Mold Decorating: A Review of Process and Technology

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In-mold decorating (IMD), also known as film-insert molding, is the process of decorating an injection-molded part with a decorated film during the injection process. The label becomes an integral part of the final product, creating a fully decorated item on the visual surface or partially as with a label on a container. This process, sometimes referred to as in-mold labeling, is primarily used to decorate containers, cups, and various vessels.

During the process, a preprinted label or decorated film is inserted into the open plastic injection mold and held in place mechanically, electrostatically, or gravitationally. When the mold is closed, plastic resin is back-injected onto the film encapsulating it permanently within the finished part. Before the advent of IMD, there were two basic options for decorating molded parts—screen printing and pasting labels onto the part. Both of these techniques cannot equal the flexibility and the durability of IMD. The technique allows for more imaginative designs that not only enhance decoration but provide functionality. The technique lends itself readily to smart surfaces, tactile keys, water-resistant products, electronic circuits, and even optical components that can be integrated in a cost-effective manner.

The majority of all the films are second-surface printed. Printing on the primary surface is less durable. Second-surface printing can be used for simple single colors as well as complex multiple-pass patterns that simulate marbled surfaces and include functional optical filters. Second-surface printing contributes greatly to the durability of the product and is a major factor in the selection of IMD. The part can be passive or active, with traces and electroluminescent surfaces being included on the film. Dead front, filers, overmold, and selective electroplating are also design options.

The IMD process essentially has three steps—printing, forming, and back injection. In-mold labeling typically skips the second step as the label is flat and pressed against the mold.



Figure 1. This bedside controller is a clamshell design, the lower half being a two-shot part. The primary shot on the lower part of the body is PC/ABS, and the second shot a seal in TPE. The upper portion of the controller (the part that is invisible in the picture) is a single-shot part also in PC/ABS. The keys are made using the in-mold design (IMD) process. The keys are printed, thermoformed, trimmed, and back injected with PC/ABS. The film is PC. The final step in the process is insert molding the single-shot top. The keys are then inserted into the mold, and a TPE seal is molded around them (this is the gray material between the keys and the white top). The TPE is flexible enough to allow the keys to be depressed to activate the audiovisual system in the room. This is a good example of creative use of IMD being integrated into an active portion of the product. The key tops are durable and bright, and the graphics are behind a protective layer of polycarbonate. The final operation of insert molding the keys to the body is an elegant way of providing good key travel and a water-resistance interface. Courtesy of Yomura