

# UV Technology for In-Mold Labeling

By Ronald B. Schultz



Printed on  
70 $\mu$  oriented  
polypropylene  
(OPP) by UV Offset



Printed UV Flexo  
on OPP

UV-cured inks and coating have become an important part of the production of in-mold labels for packaging (IML) and in-mold decoration of durable products (IMD). For 2013, 25% of in-mold labels in North America and 20% of those produced in Europe were printed with UV-cured inks. This is especially true for labels produced on narrow web flexo and web offset presses.

In-mold labeling is different from pressure-sensitive, heat-transfer or glue-on labeling which are post-mold operations. In IML, the in-mold label is placed in the mold before the

plastic container resin is injected or blown into the mold. As the resin flows into the mold, the label is embedded in the wall of the container, making the label an integral, non-removable part of the container. All post-mold operations and equipment are eliminated. In-mold labeled containers include laundry detergent bottles, cream cheese and ice cream containers, and motor oil bottles.

IMD is similar to IML in principal, but the “labels” are more robust and the in-mold decorated parts are of much higher value and intended for continuous or even harsh outdoor service. Many such products are made in multistep processes. The initial “label” may be a 10- or 20-mil clear polycarbonate which is first reverse printed with a UV ink. The printed film is then thermoformed and die cut to the shape of the final

part. This pre-formed insert is placed into an injection mold where it is backfilled with resin to form the final part. Examples of IMD products are cell phone faceplates, automotive dashboards and name plates, and washing machine control panels.

The in-mold labeling process requires inks and overcoats with superior heat resistance for both the blow mold (IML-B) and injection (IML-I) molding process. The IML-I process is especially demanding where resin is injected at high pressure and temperature against a reverse printed label. Conventional inks with inadequate heat and chemical resistance can be washed away by the hot resin as it is injected behind the label into the mold cavity.

UV-cured inks provide superior properties on in-mold labels, including:

- High gloss
- Abrasion resistance
- Chemical resistance
- Resistance to injection “washout”
- Good bonding to backfill resin for insert molding
- High durability for outdoor exposure
- Low or no volatile organic compounds
- Rapid cure

Despite the attractive performance properties of UV inks for IML/IMD, they are more challenging to use in a number of ways.

- **Curl**—In order to feed smoothly from label magazines, in-mold labels

must be as flat as possible. Any curl introduced by the converting process can be a serious problem at the molding machine. UV inks and coatings have been known to create curled labels as they cure.

- **Undercure**—Undercured UV inks and coatings can cause label blocking and offsetting of ink to the inside of the mold. When this happens, the label



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can hang up in the mold causing the molding machine to shut down. Another artifact of inadequate cure is poor slip which affects label feeding for magazines.

- **Over cure**—Over-cured UV inks and coatings can be brittle, causing hairline cracks along bend radii and corners. Water-based overprints are often applied over UV inks to avoid this problem as well as to avoid curl.
- **Heat Management**—UV lamps generate significant heat, especially on narrow web presses. IML

substrates are thin, unsupported polyolefin films which are quite extensible under tension and heat. Stretching of the web can play havoc

with print-to-print and print-to-cut registration.

- **Odor**—UV inks often have residual odors which are particularly objectionable on labels for food packaging applications.

Despite these mostly controllable issues, UV inks and coatings are becoming increasingly popular for printing in-mold labels and decorating durable molded products.

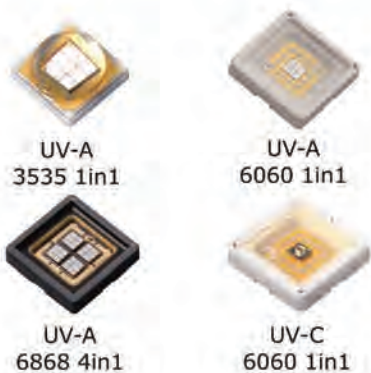
For more information about in-mold labeling for packaging and in-mold decoration of durable goods, visit the IMDA website at [www.imdassociation.com](http://www.imdassociation.com).

—Ronald B. Schultz is executive director of the In-Mold Decorating Association in Scottsdale, Ariz.

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