HIGH PRESSURE FORMING EQUIPMENT
FOR DECORATIVE AND/OR FUNCTIONAL
AUTOMOTIVE (INTERIOR/EXTERIOR) PARTS
WITH TOOLING DESIGN FOR INJECTION MOLDING

→ What are the current challenges for our technology? SMD appropriate location
→ What is our value proposition for the application of IME? Precise 3D forming

LE S S D I S T O R T I O N
H I G H P R E C I S I O N
H I G H R E P E AT A B I L I T Y

MADE IN GERMANY
NIEBLING FORMTECHNOLOGIE | IME PROCESS STEPS*

**Print and cure material stack on flat sheet**
- Print graphic inks and functional inks such as conductive inks, dielectrics, overcoats, adhesives, etc. Optimize stack order and pattern design to respect formability and other limitations of the materials. Cure and dry the stack using appropriate temperature-time profiles and sequence. Test.

**Pick-and-place SMD**
- Dispense conductive adhesives (or apply other technologies such as low-T solder if appropriate or available). Pick-and-place SMD onto the appropriate location. Cure as and if necessary. Test.

**Thermoform**
- Thermoform into 3D shape at 150-170°C using vacuum or high air pressure. Ensure that 3D shape respects formability limitations of the entire material stack as well as the attached SMDs. Test.

**Cut/trip**
- Die cut process using part-specific tooling. Assemble connectors using ACA or ACF and apply appropriate pressure-heat to enable attachment. Test.

**Injection mold**
- Hold 3D film in place by vacuum or mechanically. Injection mold at the right temperature (varies by material but typically around 275-325°C). Ensure devices and circuits survive high heat and high shear force of polymer flow front or CTE mismatch. Test.

**Test/final finishes**
- Final tests and finishes.

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* as defined by source: IDTechEx, Dr Khasha Ghaffarzadeh
VACUUM- / THERMOFORMING

- Material is heated up to the melting temp.
- Material becomes very soft
- Vacuum & low pressure (6-8 bar / 90 psi)

HIGH PRESSURE FORMING BY NIEBLING

- Material is heated up to glass transition temp.
- Material becomes formable (with stable core)
- High pressure heated air (90 bar / 1300 psi)

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VACUUM- / THERMOFORMING

- Higher material distortion
- Less precision / less repeatability
- Evaporation of humidity (water spots)
- Glue between laminates suffer
- Printed (electronic circuit) inks/solvents suffer
- Surface treatments suffer (e.g. hard coat)

HIGH PRESSURE FORMING BY NIEBLING

- Low material distortion
- High precision / high repeatability
- No evaporation of humidity
- Glue between laminates resists
- Printed (electronic circuit) inks/binders resist
- Surface treatments stay (e.g. hard coat)
Niebling´s YouTube channel