



Material and Procedural Development of In-mould Labelling Micro Powder Injection Moulding

E.Honza* **, V.Piotter *, T.Hanemann* **

*Karlsruhe Institute of Technology –KIT, Institute for Applied Materials - Material Process Technology, Germany
 ** Laboratory for Materials Process Technology, Department of Microsystems Engineering - IMTEK, University of Freiburg, Germany

Motivation

Customized, innovative and reasonable mass production of multicomponent products is still a topic in the area of the powder injection moulding. One method, set up at packaging industry, can be adapted for the processing of powder materials. The In-mould Labelling Micro Powder Injection Moulding (IML- μ -PIM) method introduced in this poster enables to **process nano- and micro-scaled powders in micro structured two-component parts**. The used materials as well as the process chain of the IML- μ -PIM must be developed to the use and processing of the ceramic and/or metallic tapes appropriately.



Tape development

- Yttria stabilized zirconia nano powder (a medium particle size of 40 nm)



density [g/cm ³]	BET [m ² /g]
5.62	36.2

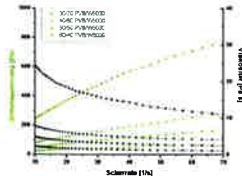
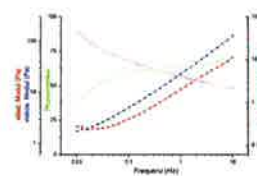
- Further components: glycerin derivative, polyvinyl butyral, Dolacol W5000, polyethylene glycol and ethanol

- Strategically approach: reduction of possible combination of components from step to step



Source: VMA Getzmann

- Rheology and oscillation investigations



Source: Malvern

- Tape casting by Doctor-Blade-Method with singular blade

- Flexible tapes with required green strength

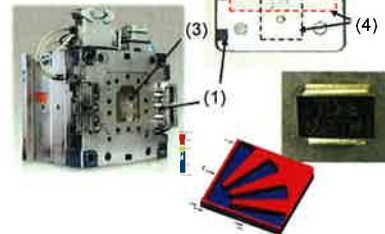


In-mould Labelling



Features of the tool:

- (1) Fixing of tapes with blank holders
- (2) Vacuum system
- (3) Variation of tape thickness between 0.1 and 1mm
- (4) Variation of micro structured mould insert position to gate

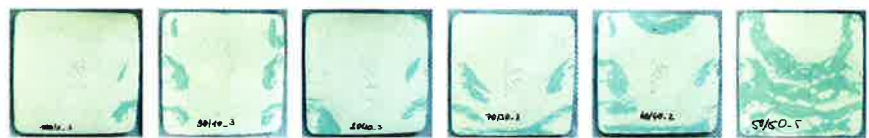


- Variation of process parameters (tool temperature, injection speed, back pressure)



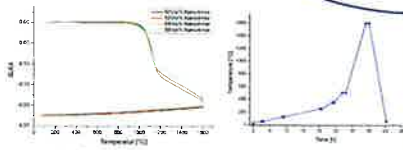
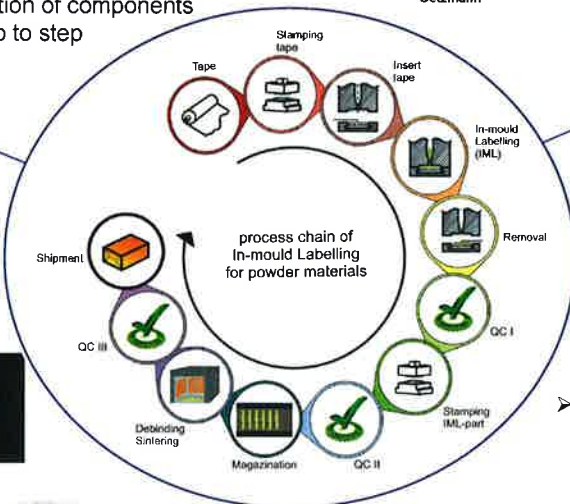
- Investigation of process control: sequential and simultaneous injection compression moulding, process combinations, variotherm processing

- Quality influence by composition, thickness and green strength of tape at IML-process



PEG-ratio

Debinding Sintering



- defect free connections between the former tape and feedstock



Conclusion

Realization of micro structured two-component parts by In-mould Labelling Micro Powder Injection Moulding process with nano-scaled powder materials is feasible. Furthermore the composition of tapes and the choice of suitable process parameter are decisive for the replication quality.