

UHPC sheet metal forming

Final Report

Motivation

In this research project, we use UHPC as a material for forming technology tooling. Due to the low material price and short manufacturing times, the use of forming tools made of UHPC is exceptionally conceivable for fast and near-series prototyping, small series, or one-off production.

Compared to conventional concretes, UHPC (ultra-high performance concrete) has a small particle size of the cement and the addition of additives. This improves the packing density, accelerating the hydration reaction and leading to higher strength properties.

Results

The UHPC optimized in the project achieves compressive strengths of up to 200 N/mm^2 , with flexural strengths of around 20 N/mm^2 . Targeted heat treatment reduces the minimum curing time from 28 days to 48 hours without negatively affecting the final strength.

Near-net-shape molds are produced quickly and flexibly using additive manufacturing processes. Molds from PLA can be constructed for multiple uses or as single-use molds.

To integrate UHPC tools into an existing tool set, additional fastening elements and cast-in structures are preferred over screw connections.

The suitability of UHPC as a tool material in forming technology was demonstrated in deep-drawing tests. Drawing with a rectangular cup geometry was possible with a deep drawing of steel and aluminum.

Summary

With UHPC tools, smaller deep drawn parts with low surface and tolerance requirements can be produced quickly and cost-effectively.

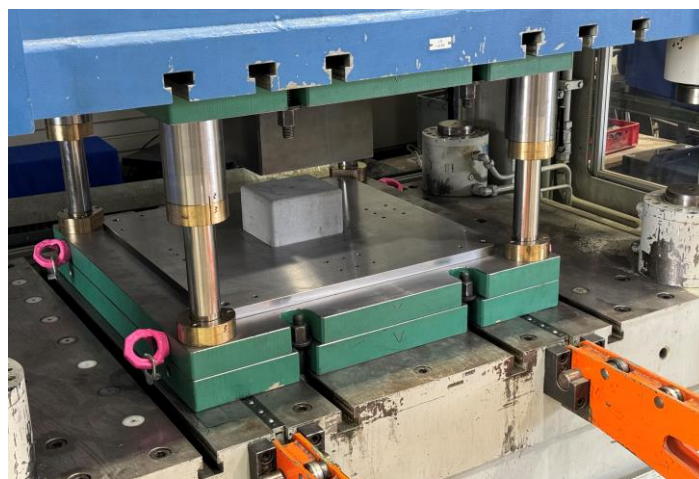


Figure: Tool set with UHPC punch integrated in a hydraulic deep-drawing press

Publications

- doi: 10.1007/978-3-031-18318-8_42
- doi: 10.1088/1757-899X/1284/1/012078
- doi: 10.1515/zwf-2023-1097

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Partnerships

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