Intrinsic Lubricated 3D Printed Tools For Deep Drawing Application

Fabian Bader[1, a)], Florian Hengsbach[2, b)], Kay-Peter Hoyer[2], Werner Homberg[1], Mirko Schaper[2]

[1] *Chair for Forming and Machining Technology, Paderborn University, Warburger Straße 100, 33098 Paderborn, Germany*
[2] *Chair for Material Science, Paderborn University, Warburger Straße 100, 33098 Paderborn, Germany*

[a)]Corresponding author: fb@luf.upb.de
[b)] hengsbach@lwk.uni-paderborn.de

Abstract. Industrial forming applications are driven by the need to increase the efficiency and to save resources. Therefore, an innovative interdisciplinary approach for the design of deep drawing tools is investigated. These new tools are manufactured with the selective laser melting process. By employing this powder-bed based 3D printing process, the fabrication of highly complex filigree parts are feasible. In opposition to the common goal of manufacturing very dense structures, here it is endevoured to achieve a compromise between the density and its strength. With regard to the tool design function integration via additive manufacturing, small channels resulting in a permeable surface for lubrication transport can be implemented. This controlled permeability of lubricant can save the normally additional lubrication process step. The area of application as well as the amount of lubrication can be controlled in a defined way. This reduces the amount of needed lubricant. Furthermore, the usage of these SLM tools in combination with an in-process closed-loop control of the lubrication expands the forming limits. High pressurization of the lubricant leads to a significant influence onto the tribosystem resulting e.g. in a hydrostatic fluid contact that eases the flange draw in darmatically. To achieve these desirable goals, extensive and thorough testing is required such as the layer distance of the printed material in regards of the permeability and the stress resistance of the tools. In this work, the permeability of the SLM-tools is investigated. Experimental tests show appealing results of deep drawn specimen with a SLM-die.