Tribo-AL-Hot

Investigation of friction and wear in temperature-supported aluminum sheet metal forming

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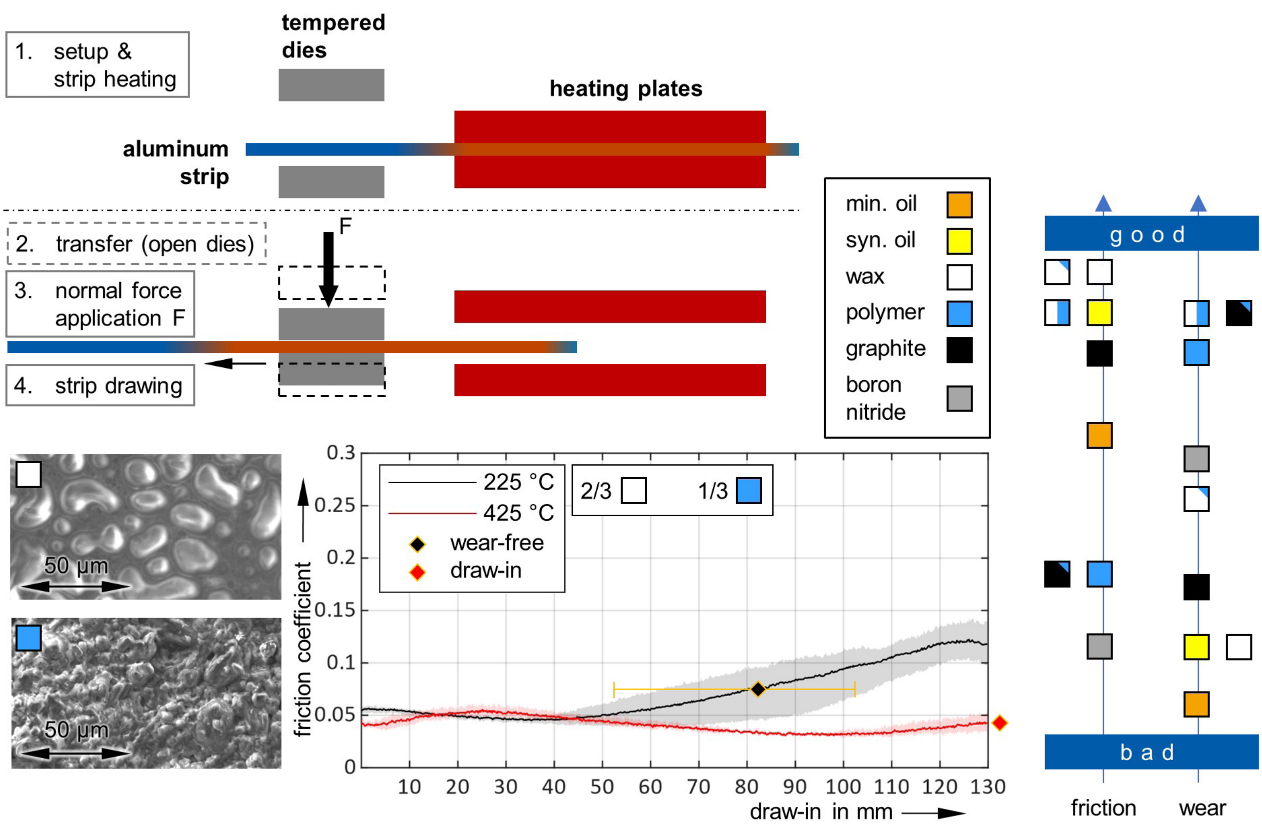
Abstract

Aluminum has been making important contributions to resource-efficient lightweight construction for decades. Ultra-high-strength aluminum sheets can only be formed with temperature-supported forming processes. In these processes, the increased temperatures push conventional lubrication systems to their limits. In a series of LOEWE 3 research projects, tribological systems for warm and hot forming were investigated. The focus was on the development and validation of a temperature-controlled strip drawing test, both for friction and wear investigations. The research topic was being worked on as a dual doctoral position with the company Filzek TRIBOtech.

Project description

Temperature-supported aluminum sheet forming promises increased formability and thus the possibility of producing highly complex sheet metal components. The core of the present project is to further develop the limited know-how for temperature-supported forming of the high-strength aluminum alloy EN AW-7075 and to increase both, the process robustness and productivity.

Tribology is a central research topic in the further development of temperature-supported sheet metal forming processes. Research into friction and tool wear under various tribological conditions is essential for the successful industrial implementation and increased robustness of these processes. The test methods used so far neither allow a satisfactory and process-related tribological investigation nor an efficient development of lubricants and tool surfaces.



[1] Testing procedure of the heated strip drawing test with exemplary results

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Results

In this project, a tribological physical simulation test for temperature-supported aluminum sheet metal forming was developed on the basis of a strip drawing test. The resulting test enables efficient test execution due to its high degree of automation. Friction and wear investigations were carried out in several test series at different temperatures and with a variety of different lubricants. This revealed lubricant-specific phenomena and friction coefficients were determined as a function of the initial temperatures of the sheet metal and tools (see Figure 1). The results were validated in a forming process and individual deviations between strip drawing tests and forming trials were analyzed. Test series in coil operation with automatic tool lubrication have shown that wear tests can be carried out efficiently. A characteristic map of the start of wear was determined as a function of the sliding distance and the normal contact stress.

Acknowledgement

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