Shear cutting: inline measurement of wear and cut quality

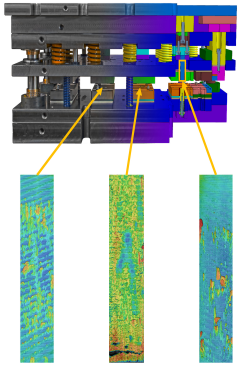
During shear cutting of sheet metal materials, inline monitoring of the tool as well as of the cut surface parameters and component quality is currently not possible. Based on the Seebeck effect this invention enables dynamic monitoring of the manufacturing process for the first time. In addition to being used in new stamping dies, the system can also be integrated into existing dies. This avoids rejected parts and extends maintenance intervals.

IP RIGHTS
EP filed
2023

Inline process monitoring by the tool itself

This invention enables real-time monitoring of process and part quality inline in the tool for the first time. The wear of the tool decisively determines the component quality and process stability. Continuous removal as well as stochastically occurring damage influence the geometry of the cutting surface and the burr. As a result, scrap parts accumulate, reducing manufacturing profitability. The feasibility of this has already been validated under industrial conditions.

01 Can be used independently of material and tool type
02 Instantaneous monitoring of process and cut surface characteristics
03 Maintains optimal tool performance
04 Easy retrofitting



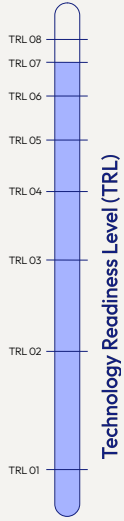
Sections of the punch states inside the test tool:
- left: uncritical adhesion
- right: localized material adhesion
- center: severe wear (adhesion with chipping at the edge of the punch)

CHALLENGE

The design conditions in shear cutting tools make the implementation of sensors very difficult. The reasons are the limited space as well as the high surface pressure. Lubricants and contaminants increase the problem. Sudden tool damage and changes in the cutting edge geometry can only be detected in retrospect. This often leads to a large number of rejected parts. Maintenance intervals are defined based on experience before the actual wear limit. This directly reduces process profitability.

INNOVATION

The solution was to create a sensor that can be used despite the conditions in the shearing tool without impacting its performance. Based on the thermoelectric Seebeck effect, which leads to the generation of voltage in vasrious sheet metal processings, it is possible to use the tool itself as a sensor. This allows instantaneous detection of stochastically occurring tool damage, as well as determination of the wear condition of the active elements independent of the wear mechanism that is occurring. The system enables the exact cuttingsurface shape determination inline at any stroke rate and for any tool.



01 Basic principles observed · **02** Technology concept formulated · **03** Experimental proof of concept · **04** Technology validated in lab · **05** Technology validated in relevant environment · **06** Technology demonstrated in relevant environment · **07** System prototype demonstrated in operational environment · **08** System complete and qualified

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