Chair of Metal Forming and Casting (*utg*)
TUM School of Engineering and Design
Technische Universität München

Seebeck-Coefficient-Adaption using Laser Metal Deposition

Reduction of Cold Welds by Systematic Adaptation of the Seebeck Coefficient of Tool Materials using Laser Metal Deposition

Motivation

Aluminum materials enjoy particular importance in the realization of lightweight construction potential. The significant adhesion tendency of aluminum materials during production processes, such as shear cutting, deep drawing or punching, is a major challenge within a wide range of industries in the mechanical engineering, automotive and aerospace industries. The material adhesion and detachment on the tools reduces the tool durability, deteriorates the product quality and increases the contamination of the machine tools.

Objective

This is precisely the research question that *utg* and the *Fraunhofer Institute for Laser Technology* (ILT) are jointly pursuing as part of a cooperative project.

The objective of this research project is to reduce adhesion formation during shear cutting and forming in order to prevent the development of flitters and to increase process stability and tool durability. Since a suppression of the thermo-electric current causes the best reduction of cold welds, the thermoelectric behavior of the tool material is specifically adapted to the sheet material in this research project. With a Seebeck testing bench, shown in figure 1, thermo-electric currents can be measured.

If both Seebeck coefficients match, naturally occurring thermo-electric currents are suppressed regardless of the temperature development in the tool, thus keeping adhesion formation to a minimum.

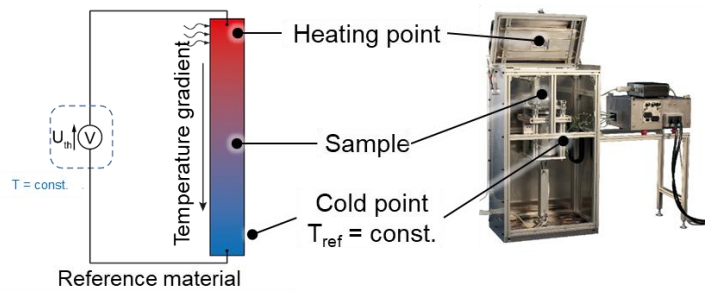

Figure 1: Schematic representation of the Seebeck testing bench

To achieve this, a tool material is coated with an established powder material by laser metal deposition, resulting in a combined system in which the Seebeck coefficients of the base and coating materials add up (see figure 2).

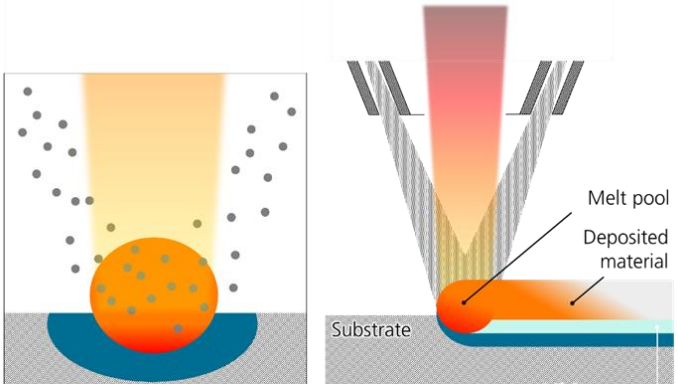

Figure 2: Laser metal deposition process

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