



Universität Bremen



Electrical Discharge Machining as Process with Main Thermal Active Principle

Subproject F02/EDM – Dr.-Ing. Andreas Klink

Objective and approach

The objective of the subproject F02/EDM is a comprehensive modeling of the thermo-physical relations of the electrical discharge machining process. Based on these models, a process signature for the electrical discharge machining process is to be created, which describes the resulting modifications of the components rim zone with the material loads resulting from the thermal impact. For this purpose, different numerical modeling approaches are used to represent the material loads but also in parts the modifications. Most of the modifications will be determined experimentally in cooperation with the characterizing subprojects.

Current state of knowlegde

A model has been developed [1] which determines the material loads as a result of thermal impact as a function of the process parameters for a single discharge. Initial investigations indicate [2] that the material load of thermal impact by the single discharge is decisive for the modifications of the workpiece rim zone. The model was subsequently validated using metallurgical studies in cooperation with C02/electron microscopy [3].

Based on the model of the material stress, a process signature component (PSC) for the modification of the residual stress could be created (right figure).



Fig.: process signature component of residual stress



A phase field modeling approach was used to model the microstructure evolution during the electrical discharge machining process [4]. The results led to a further process signature component, which reflects the retained austenite content as a function of the load due to the thermal impact (left figure). In addition, the effect of multiple loads was analyzed for the electrical discharge machining process. In the case of multiple-stage loading (roughing ► finishing), the results indicate that the locally resolved maximum residual stress of the individual process stages determines the final residual stress profile.

Conclusion and further procedure

Process signature components have already been determined for two important modifications. Multiple stresses in electrical discharge machining could also be integrated into the process signature concept. Investigations into multiple loads in process chains have already been carried out, but these are currently still being evaluated. In the following funding period, the focus will be on the functional component properties and their connection with the modifications of the workpiece rim zone in order to further develop the vision of functional component design.

Publications

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