



TU BERGAKADEMIE FREIBERG

Die Ressourcenuniversität. Seit 1765.

Fakultät für Werkstoffwissenschaft und Werkstofftechnologie

Institut für Metallformung

Prof. Dr.-Ing. Ulrich Prahel, Institutsdirektor



TU Bergakademie Freiberg, B.-v.-Cotta-Str. 4, 09599 Freiberg/Sachsen, Tel.: (03731) 39-3698, e-mail: office@imf.tu-freiberg.de

Master Thesis / Diplomarbeit

Title: Constructing formability limit diagrams for TRIP Steel, Mg-PSZ MMCs using crystal plasticity based numerical simulation modelling incorporated with damage criteria

TRIP Steel, Mg-PSZ composites are finding application in automotive industry due to their superior energy absorbing capacity, yet, the formability of these materials into desired shape depends on many factors and is still not completely understood. Formability Limit Diagrams (FLDs) of a material provide useful information about the formability of the material under various loading conditions and help manufactures in evaluating the amount of deformation a material can undergo before failing under specific loading conditions. In the current project an open source crystal plasticity based numerical simulation model DAMASK will be used with tuned TRIP/TWIP material model for steel matrix and elastic model for zirconia particles. RVE based simulations will be run with varying loading criteria incorporated with appropriate damage model to construct FLDs for a specific material. The microstructural attributes, i.e. matrix grain size, ceramic particle size will be varied to analyze the effect on FLDs. The results of a specific case will be compared with experimental data for validation. This methodology once developed will help future researchers in engineering a composite material microstructure to obtain desired formability and hence shape the material in desired shape without carrying our experimental intensive study first.

Focus of work:

- Literature review of the already carried out experiments and developed numerical simulation for the construction of FLDs of different material.
- Implementation and evaluation of numerical simulation model by using already available data.
- Presentation and critical evaluation of the results
- Comparison and classification of own results with results from the literature

Reviewer: Prof. Ulrich Prahel, Dr. Sergey Guk

Supervisor: Faisal Qayyum, Tel. 39-4073, Email: faisal.qayyum@student.tu-freiberg.de

Duration: 6 Months

Hinweis: Die Bearbeitung des Themas ist auch auf Deutsch möglich.