

Preface

The demands on metallic structures are increasingly complex, since strains and application loading profiles which appear are locally limited and inhomogeneous. Therefore high-strength structures with optimised designed materials properties have to be developed.

To guarantee an encompassing and integrated consideration of the process chain for the creation of high strength metallic structures and joints with locally scaled properties - bearing in mind the extensive interactions of the sub processes - a close collaboration of scientists from different fields is required. Thus, the Collaborative Research Centre 675 (SFB 675), for “Creation of high strength metallic structures and joints by setting up scaled local material properties”, was set up by the German Research Foundation (DFG) at the Universities of Hanover, Clausthal and the Laser Zentrum Hannover e.V. in 2006. The ambitious aims of these cooperations are scientific investigations and interpretations of the materials and process procedures of forming, manufacturing and joining for the creation of high strength structures, and the representation of these effects on chosen component properties. The research goal is to characterise the scaled material properties in such a way that product developers have the possibility of interactively designing optimised high strength metallic structures, if they possess knowledge of the material properties and suitable rules for representation: material properties will be “constructed within”. Consequently, we stay abreast of changes of paradigm: deviating from the principle to select materials to the highest expected strain, to an integrated product development and production development approach.

Therefore, the following leading questions are of particular interest to the Collaborative Research Centre 675:

- Which materials and technological-effects can be used for setting up scaled local material properties?
- Which finishing techniques can be selected in order to adapt the local component properties aligned to the load and to maintain them throughout the process chain up to the final product?
- How are structures to be designed with engineered material properties, regarding the component’s life-time? Which measures are necessary for quality assurance?

Based on the research goals and leading questions of the Collaborative Research Centre 675, mass laws and process models are investigated, which clearly and predictably describe the influence of the material parameter and process parameter to characteristic property value, shape and dimension. In this study, the developing process and manufacturing process have to be considered to be integrated beginning from the material choice about setting up scaled local material properties, up to the manufactured components.

Clausthal-Zellerfeld
March 2007

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