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Topic: Impact of Microstructure and Geometric Length Scales on Miniaturized Tensile Tests of Advanced Steels

In this work the mechanical properties of advanced steels are characterized by a miniaturized tensile test and compared to the results of other mechanical testing methods. The eleven steel raw materials were provided by *thyssenkrupp* and the miniaturized specimens were cut with a dog-bone shape contour. The specimen dimensions have a constant gauge length of 4mm, the gauge width is varying from 0.15mm to 0.5mm and gauge thicknesses between 1.5mm and 0.15mm were used. For one type of steel the dimensions were severely changed to verify an occurring specimen size effect. The influences of the geometric length scales were investigated by microstructural analysis using EBSD.

The tensile test results were correlated to Vickers hardness measurements, average grain size and *thyssenkrupp* database values for the ultimate tensile strength. Some steels reproduce the macro-scale results well in miniaturized testing whereas others show a significant drop in the performance. The overall performance of the miniaturized tensile tests were evaluated by the ultimate tensile strength and the fracture strain for one type of steel by varying the geometrical dimensions. The results suggest the inclusion of the standard deviation of the grain size distribution for a more independent evaluation of the specimen size effect.

Industrial Partner: thyssenkrupp Steel Europe AG, Kaiser-Wilhelm-Straße 100, D-47166 Duisburg
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