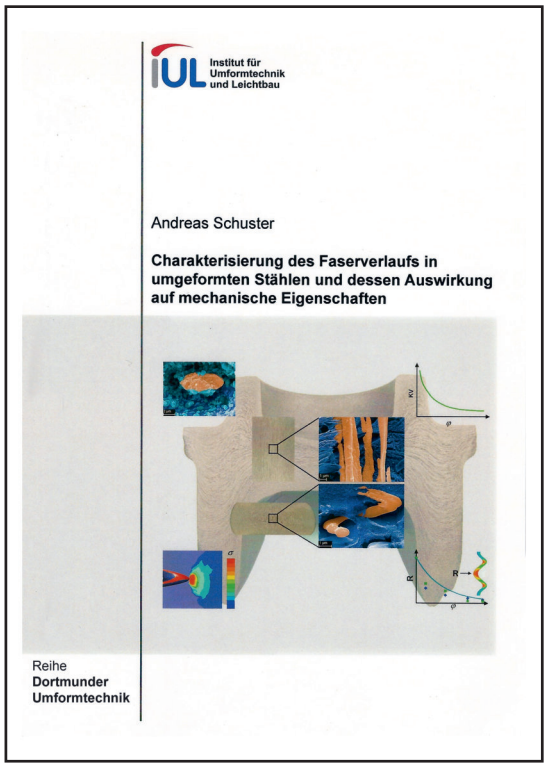
English version below

Institut für Umformtechnik und Leichtbau

Charakterisierung des Faserverlaufs in umgeformten Stählen und dessen Auswirkung auf mechanische Eigenschaften

Andreas Schuster



Reihe Dortmunder Umformtechnik - Band 70

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Zusammenfassung

The fibre flow in steels plays, beside other factors, an essential role for the evaluation of the performance of forged parts. Due to the fact that the fibre flow in literature is merely rudimental defined; one part of this work attends to clarify the origin of the fibre flow. Experimental technologies exhibit that stretched MnS, which rise from the hot rolling process of steels are mainly responsible for this structure. Additionally the conditions for the development of the fibre flow in steel are also shown.

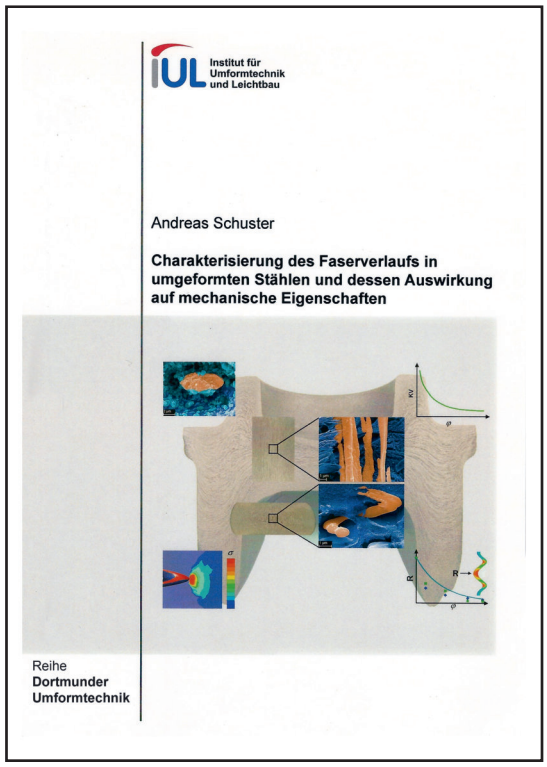
By means of scanning electron microscopy the morphologies and orientations of MnS are analyzed in continuous casted and hot rolled steel. Moreover the changing of the shape of MnS and other types of inclusions caused by a forging operation, e.g. cylindrical upsetting in rolling direction and vertically oriented is observed in 4 differend kinds of steels. Hot upsetting at 1250° C and vertically oriented to the rolling direction enables by way of the index of relative plasticity the construction of a flow curve of MnS, which is necessary for a FEM forging simulation. Additionally, the changing of the MnS morphology in dependence from the temperature is observed. Stretched MnS in hot rolled steel are influencing some characteristic mechanical properties, leading to longitudinal and transversal anisotropy of e.g. the notch impact energy in dependency from sulphur level and rolling degree. The analysis of the fracture surface of notched specimen shows the influence of the MnS morphology and orientation on the notch impact energy. Because of the changed shape of MnS, caused by hot upsetting in rolling direction, an initially present anisotropy develops to a more isotropic behaviour particularly in the core region of the upset samples. The changed morphology of MnS caused by an upsetting at room temperature does not influence significantly the changing of the anisotropy.

A FEM forging simulation of the cylindrical upsetting in rolling direction of MnS in steel shows a partial accordance of the changing of the MnS morphology between the observation and stimulated results. Considerations about the stress ratio around MnS at adequate loadings of parts show the detrimental impact of the MnS morphology and orientation on the mechanical properties of steels. Examples of use illustrate the influence of flattened and accordingly to the part loading oriented MnS.

Institut für Umformtechnik und Leichtbau

Characterization of the fiber flow in forged steels and its influence on mechanical properties

Andreas Schuster



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