

# Bulk Steel Products with Functionally Graded Properties Produced by Differential Thermo-mechanical Processing

*Steel Research Int.*, 79 (2008), No.1, 59-65 DOI: 10.2374/SRI07SP059

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For the production of bulk steel products with tailored properties a new approach of thermo-mechanical processing offers high potential for process innovations. The application of differential thermo-mechanical effects to initially homogeneous workpiece materials combines thermally controlled material flow with functional grading of mechanical properties. The key effect is the control of local microstructural transformation. The detailed investigation and description of all related phenomena, not only for forming processes of bulk steel products but also for light metals and polymers, is the main topic of the recently established Transregional Collaborative Research Centre 30, which is financed by the German Research Foundation. The comprehensive coverage of these phenomena is aimed at developing tools to govern this innovative new type of hybrid production processes. Recent optimisations of the experimental set-up in the field of hybrid metal forming offer new possibilities in the investigation of the main effects. In the following the effects of different cooling strategies on the functional gradation of properties are investigated by temperature and hardness measurements. Finite-element simulations give additional information to experimental observations. The control of these effects offers the possibility of a differential thermo-mechanical driven functional gradation of bulk steel products.

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