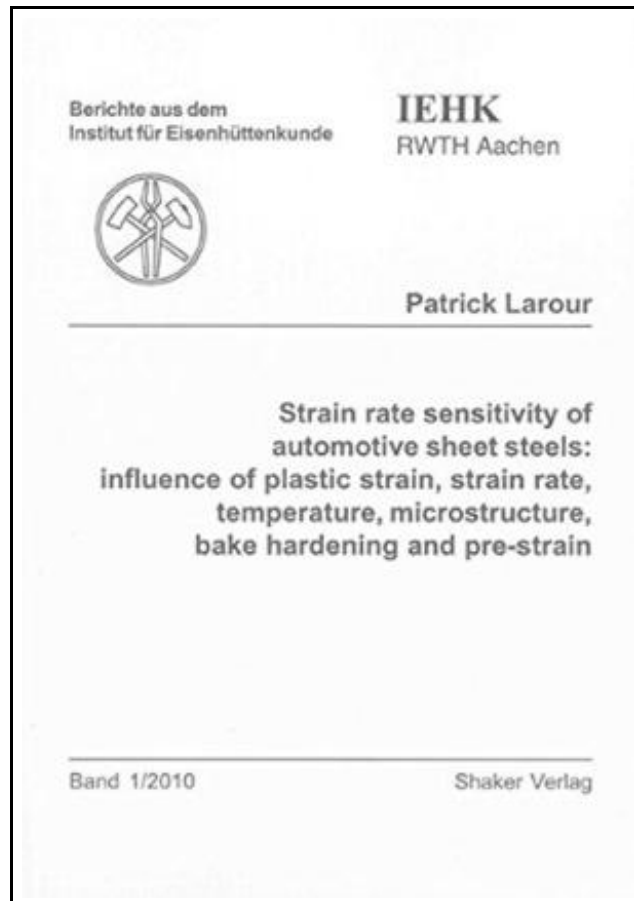


Strain rate sensitivity of automotive sheet steels: influence of plastic strain, strain rate, temperature, microstructure, bake hardening and pre-strain



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STRAIN RATE SENSITIVITY OF AUTOMOTIVE SHEET STEELS: INFLUENCE OF PLASTIC STRAIN, STRAIN RATE, TEMPERATURE, MICROSTRUCTURE, BAKE HARDENING AND PRE-STRAIN



Shaker Verlag Jun 2010, 2010. Buch. Book Condition: Neu. 21x14.8x cm. Neuware - This experimental work shows the different parameters influencing the strain rate sensitivity behaviour of automotive sheet steel grades in crash conditions. Most investigations have been performed in the strain rate range [10-3-200s⁻¹] and temperature range [233-373K] with servohydraulic tensile testing machines. Additional Split-Hopkinson bar testing results up to 103s⁻¹ have also been included at room temperature. The focus has been laid on the 'apparent' strain rate sensitivity, determined based on multiple dynamic flow curves at constant strain rate in a semi-logarithmic (b10 values) or logarithmic (m values) way. It has been shown that the dynamic behaviour in the investigated strain rate and temperature range is clearly thermally activated for a wide range of automotive sheet steels. This means that an increase in strain rate is nearly equivalent to a decrease in temperature. The strain rate sensitivity values are dependent on the strain rate range considered, as well as on the temperature and plastic deformation range chosen. The strain rate sensitivity decreases with increasing plastic strain level due to a gradual exhausting of work hardening potential combined with adiabatic softening effects. The strain rate sensitivity increases with decreasing temperature or increasing strain rate, which is often omitted when considering literature data. The strain rate sensitivity is also dependent on the microstructure investigated. The strain rate sensitivity decreases strongly with increasing strength level, especially below 400MPa yield strength or 500MPa tensile strength, and is stabilised at a low level for AHSS and UHSS steel grades. The strain rate sensitivity decreases for single phase ferritic mild, HSS and HSLA steel grades, mainly due to solid solution alloying with Mn, Si and P elements. Long range mechanisms such as precipitation hardening, grain refinement or cold work do not influence the strain...



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