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NOVEL THERMOMECHANICAL PROCESS DESIGNS FOR EXPLORING THE POTENTIAL OF HOT-ROLLED MEDIUM-Mn STEELS

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The intense worldwide investigations on sheet and bulk medium manganese steels are in progress. These multiphase steels belong to the third generation of advanced high strength steels (AHSS) and enable efficient lightweighting and safety improvement of cars and other vehicles through designing thinner geometrically optimized automotive car body and underbody elements. The mechanical performance of the steels depend on relative amounts and mechanical properties of structural constituents and the mechanical stability of retained austenite, which is affected by its chemical composition and morphological parameters. The process-microstructure-property relationships for cold-rolled medium-Mn sheet steels have been satisfactory investigated in the recent 10 years. Some potential still exists in exploitation of hot-rolled sheets and forging products.

The talk addresses latest developments in designing heat profiles and thermomechanical processes of hot-rolled medium manganese steels. The computational and experimental approaches are demonstrated for exploring the potential of lean 3-5% Mn multiphase steels for hot-rolled sheet products. The continuous cooling diagrams and deformation continuous cooling diagrams are the basis for designing the thermal cycles for fully or intecritically austenitized samples. The physical simulation of sheet coiling and double step isothermal bainitic holding are demonstrated as examples of novel thermomechanical processing designs. Moreover, the modification of conventional intercritical annealing like double step intercritical annealing is displayed. The benefits from the intercritical annealing following hot-rolling compared to cold-rolling schedules are emphasized. The effects of Al addition in a range of 0.5-1.7% and Nb microalloying on the hot-working behavior and mechanical performance are explained.

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