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(S)TEM characterization of retained austenite in a 3rd generation AHSS medium-Mn steel

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Third generation Advanced High Strength Steels (AHSS), among which medium Mn steels, have potential applications for automotive industry, due to their high balance between strength and ductility and their excellent forming properties, thanks to the presence of a high amount of metastable retained austenite, and an efficient TRIP (transformation induced plasticity) effect [1][2]. Medium Mn steels microstructure usually consists of refined ferrite, retained austenite, and sometimes fresh martensite, and are obtained through intercritical annealing. Controlling the stability and the enrichment of the austenite phase during this thermal process is of vital importance for the steel to show an efficient TRIP effect. In this work, cold-rolled ferritic samples with composition 0.2C-4Mn-0.8Al-1.5Si were processed through different thermal treatments (intercritical annealing at various temperatures, with or without pre-austenitizing annealing) to provide the different medium Mn microstructures. Further, we use (Scanning) Transmission Electron Microscopy ((S)TEM) to investigate the austenite grain structure distribution. In addition, Energy Dispersive Spectroscopy (EDS), routinely coupled with TEM, was used to provide a chemical characterization of the partitioning element Mn between γ/α which help increasing the stability of the austenite. With the results provided, it is possible to better comprehend the interplays between the different deformation mechanism (dislocation gliding, twinning and transformation induced plasticity), and the effect of local chemical gradients on austenite stability.

Keywords: Transmission Electron Microscopy, Austenite stability, TRIP effect

References:

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[2] Raabe *et al.*, “Current challenges and opportunities in microstructure-related properties of AHSS”, Metallurgical and materials transactions A volume 51a, (2020),5517-5586.