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The Role of Transformation Induced Plasticity on Damage Development in a Third Generation prototype Medium Mn Advanced High Strength Steel

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Modifications to intercritical annealing (IA) parameters with the intent of reverting and stabilizing austenite at ambient temperatures has been advancing the development of third generation (3G) Medium Mn advanced steels (AHSSs) which meet 3G mechanical targets and show continuous galvanizing compatibility [1]. Research has been invested in processing of these prototype steels, however, there is little known about the extent to which microstructural features and transformation induced plasticity (TRIP) in Medium Mn steels can suppress damage and enhance localized ductility. A 0.15C-5.8Mn-1.8Al-0.71Si experimental Medium Mn steel with significant amounts of retained austenite available for TRIP to be activated within the post-uniform elongation regime during straining is the material of interest for this work. A comprehensive understanding of microstructural damage processes leading to full fracture requires careful assessment of strain partitioning amongst phases, strain-induced microstructural evolution, and an overall identification of the micro-mechanisms of damage. These investigations can only be accomplished by tracking deformation at the micro-scale in 2D using digital image correlation (DIC) and 3D using x-ray computed tomography (XCT). Experiments are supplemented with x-ray diffraction (XRD) and electron back scattered diffraction (EBSD) to thoroughly characterize complex 3G steel microstructures [2]. To adapt this work to various stress states experienced during component forming or during a vehicle crash, notched samples will be used on the optimal IA condition to further comprehend the sensitivity triaxiality has on TRIP and damage evolution in 3G Medium Mn steels [3].

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