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Effect of banding on micro-mechanisms of damage initiation in bainitic/martensitic steels

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Abstract. Multiphase bainitic steels, as a third generation of advanced high strength steels, show promising properties for automotive applications. Understanding the micro-mechanisms of damage initiation during plastic deformation is a key to further mechanical properties enhancement. The topological effect of martensite as a second phase constituents on local damage nucleation activity is significant. This effect has been studied in two different martensite banded microstructures produced by two various annealing cycles. The post mortem damage analysis by a scanning electron microscope on uniaxial loaded samples, revealed more damage nucleation along the dispersed and fragmented martensite phase within martensite banded regions. More pronounced strain partitioning was observed in coarse bainitic grains between adjacent martensite blocks. It is shown that the fracture strain is not controlled by local damage activities, implying that earlier damage initiation or an increased volume fraction of voids does not give rise to a reduced ductility.

Keywords: Bainite; Steel; Damage initiation; Topology; Banding; EBSD

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