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Enhanced dynamic and cyclic plasticity in meta-stable $Fe_{50}Mn_{30}Co_{10}Cr_{10}$ bi-directional TRIP high entropy alloy

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In the present investigation, we study the micro-mechanims of frgormation in a meta-stable $Fe_{50}Mn_{30}Co_{10}Cr_{10}$ bi-directional TRIP high entropy alloy in compression across quasistatic and dynamic strain rate regime as well as cyclic loading in strain and stress control mode to understand the role of bidirectional transformation on dynamic and cyclic plasticity. Detailed microstructural characterization at different length scales indicated that profuse adiabatic heating induced bidirectional transformation contributed to higher ductility in the dynamically compressed sample compared to the quasistatic compressed samples. On the other hand, higher propensity of bidirectional transformation at lower strain amplitude as well as stress amplitude and mean stress contributed to higher cyclic ductility. A mechanistic perspective covering two distinct mechanisms of bidirectional phase transformation, namely the temperature and defect density induced phase transition and the reversible partial dislocation movement enabled phase transformation for the two cases along with other symbiotic strain harening and strengthening mechanisms in the fcc nd hcp phass of the alloy will be elaborated.

Keywords: transformation induced plasticity, twinning, dynamic deformation, low cycle fatigue, plasticity