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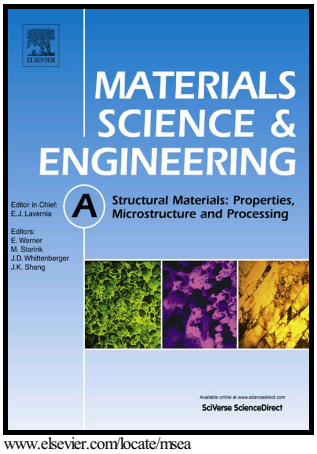

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Microstructure–Mechanical Property Correlation in Oxide Dispersion Strengthened 18Cr Ferritic Steel

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ABSTRACT

The tensile deformation of Oxide Dispersion Strengthened 18Cr ferritic steels (henceforth designated as ODS–18Cr steel) was studied over a temperature range of 298–1073 K. At each temperature, the influence of microstructure (grain size and dispersoid size) which could be refined progressively by increasing the milling time over the range 1 to 6 h on strength was also investigated. Oxide free 18Cr steel (NODS) provided the baseline data as compared to ODS–18Cr steel. At all the test temperatures, the flow stress of ODS–18Cr steels increased with increasing milling time or equivalently with refinement of the grains and dispersoids. The decrease in flow stress with increasing tensile test temperature was marginal up to 673 K. Beyond 673 K, the flow stress decreased rapidly. Enhanced strength of ODS steels when compared to NODS steel is due to the formation of ultra–fine grained structure along with fine dispersion of complex Y–Ti–O oxide particles. The concomitant roles of the grain size related strengthening and dispersion strengthening due to oxide particles in the strengthening of ODS–18Cr steels at all test temperatures were rationalized using root mean square superposition model.

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