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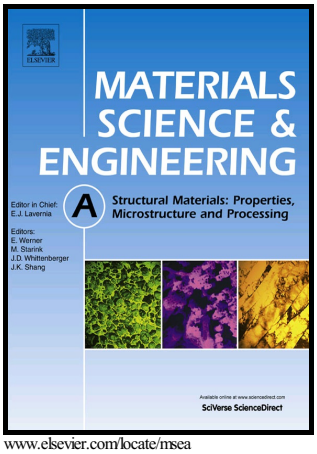

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Effect of strain path on the evolution of microstructure, texture and tensile properties of WE43 alloy

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Abstract

Hot rolling of extruded and solutionized WE43 alloy was carried out at 400 °C through different strain paths such as unidirectional rolling (UDR) and multistep cross rolling (MSCR). The effect of strain path on the evolution of microstructure and texture was investigated. The grain size was ~ 7 μm and 18 μm after hot rolling of UDR and MSCR samples, respectively. A strong basal texture was observed during rolling which is independent of the strain path of the samples and the recrystallization mechanism was identified to be continuous dynamic recovery and recrystallization type. Further, the texture of the deformed and recrystallized grains was observed to be same. Hence, the texture was simulated successfully using visco-plastic self-consistent (VPSC) simulation. The VPSC simulation of UDR sample showed the dominant activity of basal and prismatic slip system up to a true strain of ~ 0.5 and after that pyramidal <c+a> activity dominants, whereas MSCR sample showed the combined activity of basal and pyramidal <c+a> up to a true strain of ~ 0.5 and later on basal activity dominants on further deformation. The room temperature tensile testing showed that the yield strength of MSCR sample was greater than UDR sample except along RD of UDR sample and the tensile strength was more for MSCR compared to UDR sample which suggests that higher volume fraction of metastable precipitates in MSCR than UDR sample during high temperature rolling. The higher volume fraction of metastable precipitates was attributed to lower dislocation activity on prismatic planes of MSCR compared to UDR sample during hot rolling. The current VPSC simulation showed that the prismatic slip activity was four times higher in UDR than MSCR sample. A decrease in mean free path of dislocations by the presence of metastable precipitates led to higher tensile strength of MSCR compared to UDR sample. The mean free path of dislocations increased from RD to TD and hence, results in a decrease in tensile strength from RD to TD of both the samples.