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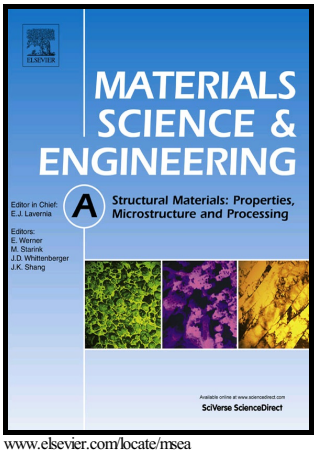

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Effect of oxygen content on active deformation systems in pure titanium polycrystals

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Abstract

The Ti-0.1 wt% O and Ti-0.3 wt% O polycrystals were compressed along the extrusion direction and the incidence of different deformation modes were evaluated by electron backscattered diffraction (EBSD)-assisted slip trace analysis. It was found that a transition from single prismatic slip in Ti-0.1O to double prismatic slip or multiple slip in Ti-0.3O polycrystals dominated flow was observed. The reason for such transition was associated with the decreasing of $\mathrm{CRSS}_{\mathrm{pyramidal}}/\mathrm{CRSS}_{\mathrm{prismatic}}$ ratio and the increasing of *c*/*a* ratio as the oxygen content increasing. Meanwhile, the deformation twins were less observed in Ti-0.3O than that in Ti-0.1O polycrystals, and all the characterized deformation twins were $\{10\bar{1}2\}\langle\bar{1}011\rangle$. Interestingly, because the influence of the grain orientation and high local stress concentrations, $\{10\bar{1}2\}\langle\bar{1}011\rangle$ twins with lower Schmid factor (SF) than that of prismatic slip were often activated in Ti-0.1O polycrystals. As the oxygen content increases, the interaction between the solute oxygen and the core of crew dislocation was enhanced, and the mobility of the dislocation becomes difficult. As a consequence, the compressive yield stress of Ti-0.3O was about 2.5 times that of Ti-0.1O polycrystals.

Keywords: Pure titanium; Oxygen; Deformation systems; Trace analysis; EBSD