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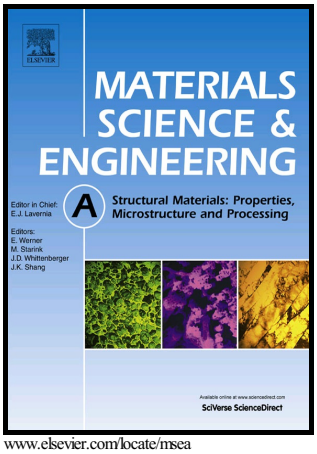

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Abstract

Prior austenite grain boundaries (PAGBs) are one of the essential microstructural constituents of lath martensite (LM). According to former studies, deformation induced micro-cracks in LM are predominantly induced along the PAGBs; a phenomenon that could be correlated either to (i) solute element segregation, or to (ii) specific crystallographic features in the vicinity of the PAGBs. In this study, we investigate the second aspect. First, a thorough crystallographic analysis is carried out on the variants adhering to the PAGBs in LM. The fracture strength of individual PAGBs is then evaluated using micro-cantilever bending experiments. The results are analyzed with respect to various variant selection rules and it is found that martensite laths at PAGBs most frequently obey a Kurdjumov-Sachs orientation relationship (K-S OR) with both their neighboring prior austenite grains (i.e. they are keeping a double K-S OR). Many of the PAGB-adhering variants also have their maximum transformation-induced strains aligned parallel to the PAGB plane for better strain accommodation. The local micro-mechanical experimental results indicate that the PAGB segments that are bound by coarser variants, and, particularly, obey the double K-S OR variant selection rule, are more resistant to crack nucleation than others. It is proposed that