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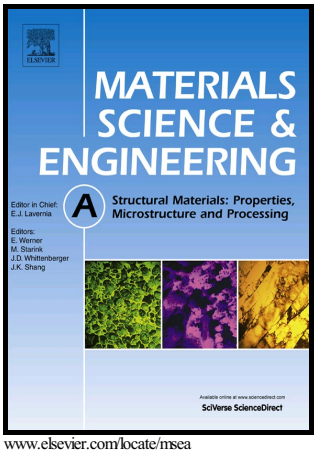

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Delamination toughening assisted by phosphorus in medium-carbon low-alloy steels with ultrafine elongated grain structures

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Abstract

The effect of phosphorus (P) on delamination toughening was examined for 0.4%C-1%Cr-0.7%Mn-0.2%Mo steels (mass%) comprised of ultrafine elongated grain (UFEG) structures with strong <110>//RD fiber textures. The UFEG structures evolved through the plastic deformation of tempered martensitic structures by multi-pass caliber rolling at a temperature of 773 K (warm tempforming, WTF). The addition of P, up to 0.093% (mass%), had little influence on the evolution of the UFEG structure and the strength of the steels. Although the tensile ductility and upper-shelf energy showed a slight tendency to decrease as