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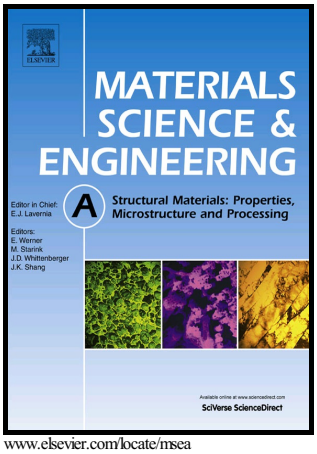

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Ultrafine Grained Dual-phase Martensite/Ferrite Steel Strengthened and Toughened by Lamella Structure

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Abstract

Grain refinement is one of the most effective methods for strengthening steels, but grain refinement to 1μm or less deteriorates the ductility considerably. To evade the strength-ductility trade-off, a lamellar-structured (LS) ultrafine-grained (UFG) dual-phase (DP) ferrite/martensite (F/M) steel was produced by warm rolling an intercritical annealed low-carbon martensite and subsequent air cooling in this paper. The microstructure is similar to a short fiber reinforced composite, and the highest strength (1432±15 MPa) combined with a decent ductility (16.5±0.5% elongation) is achieved in DP steel. Compared with conventional equiaxed coarse-grained (CG) and UFG DP counterparts, the LS martensite in UFG DP steel can produce extra strengthening effect and is also beneficial to ductility. And the short fiber theory can predict the strength very well.

Graphical Abstract