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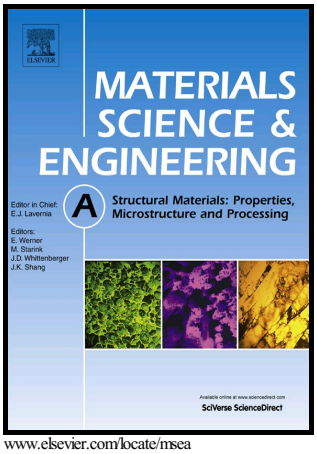

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Surface strengthening behaviors of four structural steels processed by surface spinning strengthening

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Abstract

Surface strengthening is an effective method to improve the service life of some important engineering components. In this study, four structural steels with different yield strength were treated by surface spinning strengthening (3S) technology, which created a hardened layer in the surface layer by applying the shear stress and compressive stress. As a result, the grains in the surface layers were refined to different dimensions with the increase of the depth to the surface, and the grains in the topmost surface layer were refined to nano-scale. The microhardness in the hardened layer increases dramatically due to the grain refinement and strain strengthening. Furthermore, an exponential-type microhardness model for the hardened layer was proposed to characterize the surface strengthening behaviors of the four structural steels with different yield strength. Especially, in the model, some parameters related to the nature of the hardened layer, including Hv_M/Hv_m (maximum microhardness increment ratio), λ (thickness of the hardened layer), R (surface strengthening exponent) and E (surface strengthening energy) were analyzed on the basis of the microstructure and microhardness evolution in the hardened layer. Results show that with the increase of the yield strength, Hv_M/Hv_m, λ and E/Hv_m are decreasing, while R