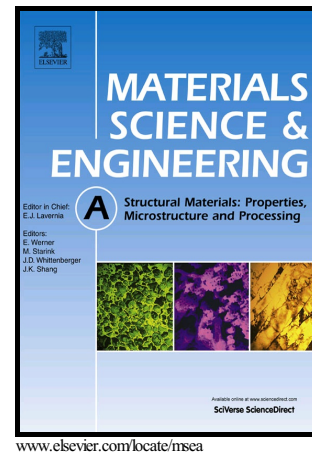


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Torsion delamination and recrystallized cementite of heavy drawing pearlite
wires after low temperature annealing

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Abstract:

Relationship between torsion delamination and cementite recrystallization in heavily cold drawn pearlitic steel wires was investigated following low temperature annealing. It was found that torsion delamination occurred inevitably when the wires underwent annealing at temperatures ranging from 210°C to 350°C with duration from 2 min. to 60 min. The torsion angle corresponding to uniform torsional deformation of annealed wires was dropped about 10% as compared to the as-drawn wires. The torsional tolerance is independent of tensile mechanical properties when subjected to annealing treatment. Low temperature annealing didn't alter the morphology of cementite in the wires, but instead it changed cementite structure from disordered (i.e., near amorphous) to nano-crystalline state. After low temperature annealing, dislocation cells formed in ferrite during torsion tests. The recrystallized cementite impeded dislocation motion and was found to break up around high-density dislocation zones. Micro-cracks resulting from torsion delamination were observed near damaged cementite sites. By contrast, in as-drawn steel wires cementite and ferrite deformed in a coherent and coordinated manner. In doing so, the wires exhibited a greater tolerance to torsion damage.

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