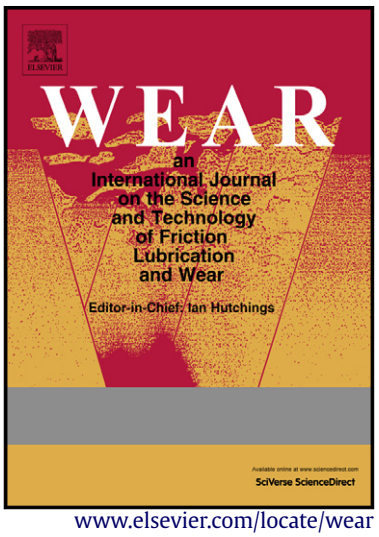

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Erosive wear analysis of medium carbon dual phase steel under dry ambient condition

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Abstract

Dual phase (DP) steel also termed as advanced high strength steel (AHSS) is a two phase material consisting of hard martensitic islands embedded in a relatively soft and ductile matrix of ferrite, finds application in pipelines for slurry transportation, wire meshes and car bodies due to its discontinuous yielding behaviour and excellent formability. Keeping in view the importance of this steel, three different dual phase (DP) structures were developed by inter-critical annealing (ICA) of a normalised steel containing 0.4% C at 740˚C temperature for 2, 4, and 5 minutes, respectively, followed by water quenching. The martensite volume fraction (MVF) was observed to be 0.36, 0.59 and 0.72. The hardness and tensile strength improved with increasing MVF but at the expense of ductility. Erosive wear tests were conducted on air-jet erosion test rig using silica sand (avg. size 200 µm) as the abrading material at three different velocities of 45, 72 and 95 m/s for three different angles of impingement 30˚, 60˚ and 90˚ for all the DP steel and the normalized steel to examine the effect of velocity and impact angle and to explore the correlation between microstructure and erosive behaviour of DP steels. The results indicate that the erosion resistance improves by formation of a dual phase structure because of better coherency between the martensite and ferrite which is poor in case of ferrite-pearlite structure and the erosion resistance increases with increasing amount of martensite. The erosion rate of the dual phase steels was observed to be higher at 30˚ and 95m/s impact velocity i.e. at high velocity and low impact angle due to the combined effect of sliding and impact of erodent particles. The mechanism of material removal was observed to change from ductile to brittle with the change in the angle of impingement.

Keywords: dual phase steel, intercritical annealing, erosive wear and quenching.

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