Effects of laser surface texturing on the wear and failure mechanism of grey cast iron reciprocating against steel under starved lubrication conditions

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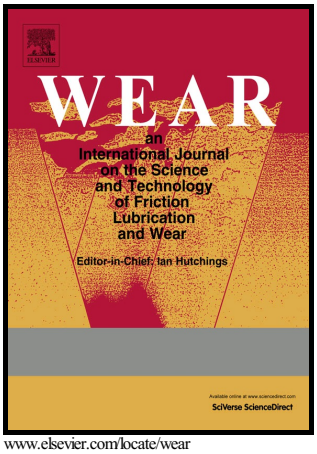

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Effects of laser surface texturing on the wear and failure mechanism of grey cast iron reciprocating against steel under starved lubrication conditions

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Abstract

The purpose of this work was to investigate the effects of different texture patterns and orientations on the wear and failure mechanisms of grey cast iron sliding against 42CrMo6 steel. Reciprocating tests were performed on 16 different micro-textures under starved lubrication conditions. The textures were designed using a design of experiments (DoE) approach and produced by a nanosecond-laser. Under starved lubrication conditions, the non-textured samples always failed catastrophically by scuffing, which is a sudden and catastrophic failure. However, textured samples showed two different wear and failure mechanisms. It is revealed that the sudden and catastrophic failure due to scuffing can be avoided by surface texturing. Choosing the right distance between the micro-textures can change the surface damage mode from scuffing to a more gradual oxidative wear mechanism. For the studied tribo-system, it was shown that if the distance of micro-textures in the direction of sliding (*DMS*) is less than 3 mm, samples will fail by an oxidation mechanism. For textured samples with *DMS* greater than 3.5 mm, the failure mechanism is scuffing, the same as for the non-textured cast iron.