Fatigue Strength and Fracture Mechanism of Thermally Sprayed WC-Co Coating on a Medium Carbon Steel by HVOF (Influence of spraying powder and coating thickness)

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Abstract

Fatigue strength and fracture mechanism of a medium carbon steel with HVOF thermally sprayed WC-Co coatings were investigated under rotating bending. Two types of commercially available WC-Co powders were used, which have similar total chemical composition with different manufacturing processes. The fatigue strengths of the specimens with thick coatings were lower than that with thinner ones. Especially, it was found that the fatigue strengths of the thick coating specimens decreased more greatly than that of the grit blasted ones. Also, the morphology of the fatigue crack depended on the type of powders and the thickness of the coating. Furthermore, an embedded Al_2O_3 grit and a crack generated during the grit blasting were found near the fatigue fracture origin of the coated substrate.

HVOF THERMALLY SPRAYED WC-Co COATINGS are widely used in applications requiring wear resistance, particularly in aerospace, oil and paper industries. The fatigue properties of these coatings are important in their practical application. However, there are few papers published on this subject (Ref 1-6). In particular, there is little information with respect to fatigue cracks in thermally sprayed WC-Co coatings.

The fatigue cracks generally form at the points of maximum local strength and minimum local strength. Therefore, to evaluate the fatigue strength of the thermally sprayed components, it is necessary to study the mechanism of the initiation and the growth of the fatigue cracks in the coatings.

The present paper describes the results of an investigation of the fatigue strength and the fatigue behavior of the thermally sprayed WC-Co coatings on a medium carbon steel by HVOF, the objective of which was to characterize the fatigue cracks in coatings and to identify the important mechanisms of the fatigue fracture.