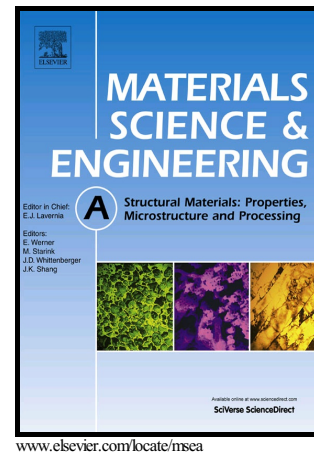


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ACCEPTED MANUSCRIPT

Use of multi-step loading small punch test to investigate the ductile-to-brittle transition behaviour of a thermally sprayed CoNiCrAlY coating

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Abstract

Small punch tests under multi-step loading conditions were performed to characterise the ductile-to-brittle transition behaviour of a high velocity oxy-fuel (HVOF) thermally sprayed CoNiCrAlY (Co-31.7%Ni-20.8%Cr-8.1%Al-0.5%Y (wt%)) coating. Small punch specimens, 8 mm in diameter and ~ 0.4 mm in thickness, were tested between 21 °C (RT) and 600 °C. A 100 N load was applied in increments every 30 mins as a step to investigate the coating deformation at different temperatures. The displacement and strain obtained from multi-step loading SPTs at each load increment were small below 500 °C but a significant increase was noted at 600 °C. The strain rate behaviour was more distinct at 600 °C and large plastic deformation were shown, which is likely due to the ductile-to-brittle transition occurred between 500 – 600 °C. Fractographic investigation revealed that the fracture surfaces at low temperatures exhibited flat features with isolated β -phase particles, indicating the inter-splat shearing and brittle failure, whereas the main fracture mode was dominated by extensive ductile tearing at 600 °C.

Keywords: Small punch test; MCrAlY coating; HVOF spraying; DBTT; Strain

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