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Impact Deformation and Fracture Behaviour of Cobalt-Based Haynes 188 Superalloy

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Abstract : The impact deformation and fracture behaviour of cobalt-based Haynes 188 superalloy are investigated by means of a split Hopkinson pressure bar. Impact tests are performed at strain rates ranging from 1×103 s-1 to 5×103 s-1 and temperatures between 25°C and 800°C. The experimental results indicate that the flow response and fracture characteristics of cobalt-based Haynes 188 superalloy are significantly dependent on the strain rate and temperature. The flow stress, work hardening rate and strain rate sensitivity all increase with increasing strain rate or decreasing temperature. It is shown that the impact response of the Haynes 188 specimens is adequately described by the Zerilli-Armstrong fcc model. The fracture analysis results indicate that the Haynes 188 specimens fail predominantly as the result of intensive localised shearing. Furthermore, it is shown that the flow localisation effect leads to the formation of adiabatic shear bands. The fracture surfaces of the deformed Haynes 188 specimens are characterised by dimple- and / or cleavage-like structure with knobby features. The knobby features are thought to be the result of a rise in the local temperature to a value greater than the melting point.

Keywords : Haynes 188 alloy, impact, strain rate and temperature effect, adiabatic shearing
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