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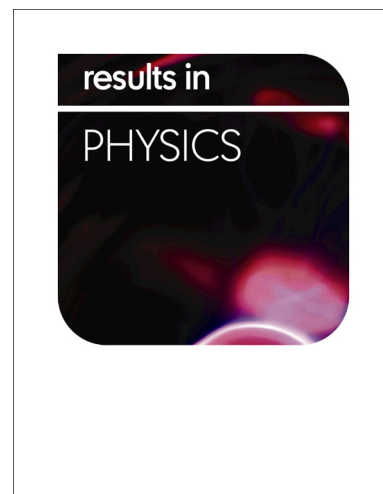
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Effect of shot peening on the fatigue properties of nickel-based superalloy  
GH4169 at high temperature

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**Abstract**

This study investigates the influence of shot peening on the fatigue properties of GH4169 alloy at 20°C, 350°C and 650°C in air. Work hardened layer with nanocrystals and deformation twins was generated in GH4169 surface after shot peening. Nanocrystallization process of microstructures was deeply discussed. The effect of twin morphology and compressive residual stress on fatigue properties was then analyzed in detail. Also, the fatigue fracture mechanism was systematically investigated. Results show that the depth of work hardened layer is about 96 μm and the increment of microhardness for the topmost surface reaches approximately 34.6%. Grains are refined to about 9 nm in the topmost surface after shot peening. Original twins are roughened or even disappear as test temperature gradually increases. The fatigue properties of shot peening specimens can be greatly improved by shot peening, especially at low external stress and test temperature (20°C and 350°C). The improvement of fatigue properties is mainly attributed to the induced nanocrystals and deformation twins, as well as strain hardening and compressive residual stress in surface layer.

**Keywords:** High temperature fatigue; GH4169 alloy; Shot peening; Surface strengthening

**Nomenclature:**  $\delta$ , phase (Ni<sub>3</sub>Nb);  $R$ , stress ratio;  $L$ , refined structure;  $G$ , shear modulus;  $b$ , Burgers vector;  $\tau$ , shear stress;  $\sigma_{\max}$ , maximum stress;  $\Delta K$ , stress intensity

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