Surface characterization and fatigue evaluation in GH4169 superalloy : Comparing results after finish turning; shot peening and surface polishing treatments

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Surface characterization and fatigue evaluation in GH4169 superalloy : Comparing results after finish turning; shot peening and surface polishing treatments

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Abstract: In this study, shot peening was applied to the GH4169 superalloy, and the surface polishing treatment effect on fatigue life of shot-peened specimens was investigated. The surface layer properties after five kinds of integration processes were carefully characterized using a contact profilometer, 3 dimensional optical devices, vickers hardness tester, X-ray diffraction and scanning electron microscopy. The rotating bending fatigue tests were performed at room temperature to evaluate the effect of different integrated processes on the fatigue properties of GH4169 superalloy. The results showed that the longest fatigue life of 4.93×10^5 cycles and sub-surface fatigue crack nucleation are obtained after TS3P process. Compared with FT, TS1, TS2, TS3 process, the TS3P process improves approximately the 699 %, 62.7 %, 71.8 %, and 48.9 % fatigue life of GH4169 superalloy, respectively. This is because the TS3P process has the lowest surface roughness(R_a = 0.041 μm), the large compressive residual stress layer (h_r = 100~330 μm) and hardening layer (h_H = 95 μm).

Keywords: GH4169 superalloy; shot peening; surface characterization; fatigue life; fatigue fracture.

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