

Hot Deformation Behavior and Recrystallization of Inconel 718 Superalloy under Double Cone Compression

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Abstract : The hot deformation behavior of Inconel 718 alloy was studied by uniaxial compression tests under the deformation temperature of 940~1040°C and strain rate of 0.001-10s⁻¹. The double cone compression (DCC) tests develop strains range from 30% to the 79% strain including all intermediate values of stains at different temperature (960~1040°C). DCC tests were simulated by finite element software which shown the strain and strain rates distribution. The result shows that the peak stress level of the alloy decreased with increasing deformation temperature and decreasing strain rate, which could be characterized by a Zener-Hollomon parameter in the hyperbolic-sine equation. The characterization method of hot processing window containing recrystallization volume fraction and average grain size was proposed for double cone compression test of uniform coarse grain, mixed crystal and uniform fine grain double conical specimen in hydraulic press and screw press. The results show that uniform microstructures can be obtained by low temperature with high deformation followed by high temperature with small deformation on the hydraulic press and low temperature, medium deformation, multi-pass on the screw press. The two methods were applied in industrial forgings process, and the forgings with uniform microstructure were obtained successfully.

Keywords : inconel 718 superalloy, hot processing windows, double cone compression, uniform microstructure

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