Thermally activated phenomena occurring simultaneously in super alloy Inconel 718: Oxygen Assisted Intergranular Cracking; Dynamic Strain Aging; δ and δ′ precipitation

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The superalloy Inconel 718 is widely used in high temperature industries because of excellent mechanical properties and corrosion resistance. But above 600°C, superalloy 718 is affected by Oxygen Assisted Intergranular Cracking (OAIC), causing brittle intergranular cracking. Impacting on mechanical properties occurs simultaneously the precipitation or coalescence of coherent δ' and δ'' phases and Dynamic Strain Aging (DSA). The objective of this work is to investigate the interactions between these phenomena, OAIC, DSA and precipitation hardening in the annealed superalloy 718. Tensile tests were performed under secondary vacuum at different strain rate and temperatures. The fracture surfaces were observed by SEM and the precipitation particles by TEM. The results showed that DSA and δ' and δ'' precipitation are responsible for the high strength at elevated temperature of this alloy but have no role in the sharp decrease in ductility.