

## **Study of Low Cycle Fatigue Behavior of Nickel Base Super Alloy for High Temperature Thermal Power Plant Applications**

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### **ABSTRACT**

Low cycle fatigue (LCF) evaluation and analysis of a candidate material CCA617, a Ni-base super alloy, applicable to a high efficiency coal fired boiler super heater and re-heater tube sections was carried out in this present study. This study is useful for design of the components. LCF tests have been performed in full reversal, axial mode with total strain control at strain ranges of 0.5 %, 0.8 %, 1.2 % and 2.0 % for each temperature and at the temperatures of 650°C, 700°C, 750°C and 800°C. The results show a decrease in fatigue life with increase in strain range and temperature. A consistent cyclic hardening behavior and serrated flow of maximum peak stress were observed. Serrated flow indicates dynamic strain aging (DSA) behavior in CCA617. Constants of Coffin-Manson relationship were estimated at each temperature and are reported in this work. Using Ramberg-Osgood relationship, stress-plastic strain was evaluated and it was inferred that degree of strain hardening of CCA617 increases with increase in plastic strain amplitude. Fractured surfaces after LCF testing have been analyzed under Field Emission Scanning Electron Microscope (FESEM) for understanding crack origin location and propagation mechanisms. The LCF properties evaluated for CCA617 is useful for high temperature thermal power plant boiler applications.

*Keywords: Low cycle fatigue; Cyclic hardening; Dynamic Strain Aging (DSA); Serrated flow; Transgranular fracture*