# Oxide Dispersion Strengthened Steels for High Temperature Applications

Overview

Oxide dispersion strengthened (ODS) Ferritic-Martensitic/Ferritic/Austenitic steels are endowed with high temperature strength and resistance to creep, fatigue, oxidation and hot corrosion. Hence, these steels are potential candidates for the components in nuclear reactors, gas and ultra super critical steam turbines which are exposed to temperatures up to about 700°C. The high temperature properties of ODS steels are due to the fine grained microstructure, nanosized oxide (Y-Ti-O complex) dispersoids and stability of the microstructure at high temperatures. ARCI has embarked on major programmes for development and demonstration of technologies for the manufacture of blades for ultra super critical steam turbines, clad tubes of fast breeder reactor and high pressure compressor and low pressure turbine blades for gas turbines.

Key Features

- High operating temperature of 650-700°C
- High yield strength and creep resistance
- Potential candidates to replace nickel based super alloys
- Resistance to swelling under irradiation
- Established manufacturing processes
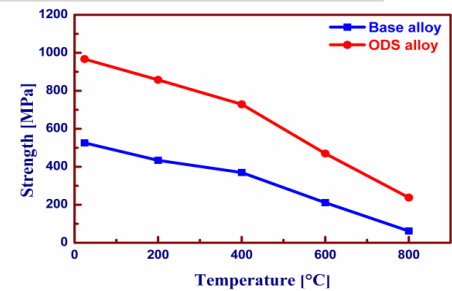
Variation of strength with temperature

Potential Applications

- Blades for ultra super critical steam turbines
- High pressure compressor and low pressure turbine blades of gas turbines
- Clad tubes for nuclear reactors
- Structural materials for fusion reactors
- Other high temperature applications

500 MW first stage ODS steel blade

Intellectual Property Development Indices (IPDI)

- Established manufacturing processes at pilot plant scale
- Performance and stability are validated at prototype level
- Further evaluation is underway

Clad tube of Fast breeder reactor

Status	1	2	3	4	5	6	7	8	9	10

Major Patents / Publications

1. M. Nagini, R. Vijay, M. Ramakrishna, A.V. Reddy and G. Sundararajan, "Effect of duration of milling on microstructural and mechanical properties of ODS-9Cr steel", Mater. Sci. Eng. A, 620 (2014) 490-499.

2. M. Nagini, R. Vijay, Koteswararao V. Rajulapati, K. Bhanu Sankara Rao, M. Ramakrishna, A.V. Reddy and G. Sundararajan, "Effect of process parameters on microstructure and hardness of oxide dispersion strengthened 18Cr ferritic steel", Metall Mater. Trans. A, 47 (2016) 4197-4209.

3. K. Suresh, M. Nagini, R. Vijay, M. Ramakrishna, Ravi C. Gundakaram, A.V. Reddy and G. Sundararajan, Microstructural studies of oxide dispersion strengthened austenitic steels, Mater. Design, 110 (2016) 519-525.