

# International Advanced Research Centre for Powder Metallurgy & New Materials (ARCI)

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## Oxide Dispersion Strengthened Iron aluminides for High Temperature Applications

### Overview

Iron aluminides ( $\text{Fe}_3\text{Al}$ ) are potential candidates for high temperature structural application due to its light weight and attractive properties such as high strength, resistance to oxidation, sulfidation and corrosion and low cost of production. However, poor ductility, inadequate creep resistance and low fracture toughness limits their commercial applications. Attempts are being made at ARCI to improve these properties. Oxide dispersed strengthened iron aluminides (ODS  $\text{Fe}_3\text{Al}$ ) offers an excellent opportunity to improve both ductility and creep resistance due to fine grained microstructure, nano-sized oxide ( $\text{Y-Zr-O}$  complex) dispersoids and stability of the microstructure at high temperatures.

### Key Features

- High operating temperature of 650-700°C
- Light weight
- High yield strength and creep resistance
- Potential candidates to replace nickel based super alloys
- Excellent oxidation and corrosion resistance

### Potential Applications

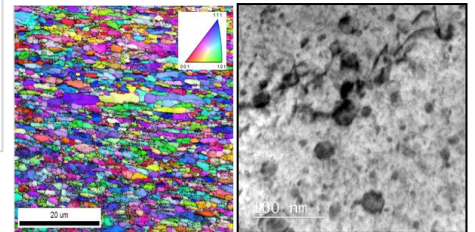
- Blades for ultra super critical steam turbines
- High pressure compressor and low pressure turbine blades of gas turbines
- Other high temperature applications

### Technology Readiness Level (TRL): 4

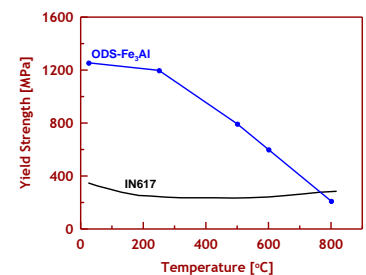
- Established manufacturing processes at pilot plant scale
- Performance and stability are validated at prototype level
- Further evaluation is underway



ODS  $\text{Fe}_3\text{Al}$  extruded rod



EBSD map and TEM bright field image which shows fine oxide particles of ODS  $\text{Fe}_3\text{Al}$



Variation of strength with temperature

IPDI*	1	2	3	4	5	6	7	8	9	10
Activities	Basic concepts and understanding of underlying scientific principles	Short listing possible applications	Research to prove technical feasibility for targeted application	Coupon level testing in stimulated conditions	Check repeatability/consistency at coupon level	Prototype testing in real-life conditions	Check repeatability/consistency at prototype level	Reassessing feasibility (IP, competition technology, commercial)	Initiate technology transfer	Support in stabilizing production
Status										

\*IPDI : Intellectual Property Development Indices

### Major Patents / Publications

#### Centre for Nano Materials (CNAM)

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