

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

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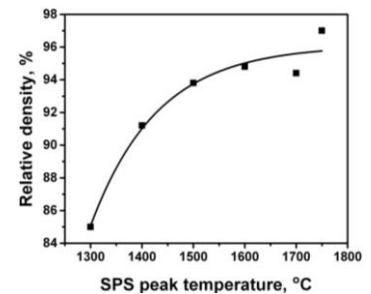
W-1 wt%La₂O₃ Composite for Plasma Facing Components

Overview

Among the refractory metals, tungsten possesses excellent combination of high temperature properties and high melting point (highest of all metals). Also it exhibits low sputtering yield under irradiation. Therefore, tungsten is the suitable candidate material for the plasma facing component (PFC). However, W suffers from high ductile–brittle transition and low recrystallization temperatures which limit the application of commercial W. These drawbacks are to some extent addressed by the incorporation of oxide or carbide particles having high thermodynamic stability in tungsten. Among the W composites, lanthanum oxide dispersion strengthened tungsten (W–La₂O₃) exhibits higher recrystallization temperature with only marginal decrease in thermal conductivity compared to pure W. ARCI has successfully developed this composite material with a relative density of 97.5% having a grain size of 10 ±2 μm.

Key Features

- Consolidated using two-step sintering process to achieve pore-boundary separation
- Relative density as high as 97.5%
- Grain size of tungsten 10 ±2 μm.
- Hardness of 600 HV₁
- Component size range: 30 – 100 mm diameter



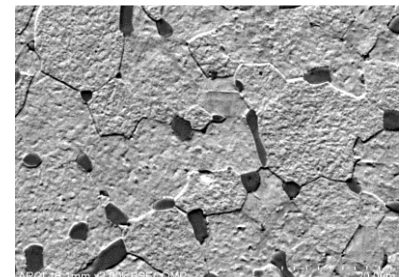
Relationship between SPS peak temperature and relative density obtained in W-1 wt%La₂O₃ composite

Potential Applications

- Plasma facing components
- TIG welding electrodes
- High temperature heat shields / reflectors
- Furnace parts
- Heating elements

Intellectual Property Development Indices (IPDI)

- Consistency of processing this composite on coupon level is achieved
- Density, hardness and microstructural parameters meets the criteria for the selection of PFCs



Back scattered electron (BSE) micrograph of W-1 wt% La₂O₃ composite sintered at 1750 °C

Status	1	2	3	4	5	6	7	8	9	10

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