

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

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## Transparent ceramics by Spark Plasma Sintering

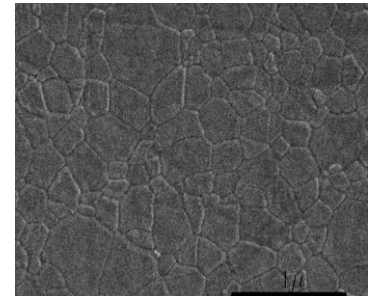
### Overview

Transparent alumina with maximum transmittance 80% was obtained over the entire mid-IR wavelength range of 3–5  $\mu\text{m}$  by applying a high stress of 275 MPa at 1150°C using specially designed high-strength compound dies in SPS. At lower stresses and sintering temperatures, transmittance reduced drastically due to remnant pores in the matrix as observed from the microstructural analysis. The effect of porosity was found to be critical in developing transparency as even a marginal decrease in porosity led to substantial increase in transmittance.

Transparent spinel was also developed in SPS at 1300°C under nominal applied stress of 50 MPa.

### Key Features

- Transmittance > 80% achieved by optimal processing
- Full density achieved
- Porosity < 0.05% obtained
- Uniform grain size and high hardness
- Applied pressure plays a critical role in exhibiting transparency



SEM of transparent alumina SPS at 1150°C

### Potential Applications

- Optical and optoelectronic applications



### Intellectual Property Development Indices (IPDI)

- The conditions for obtaining best optical transmittance has been optimized in SPS
- FTIR studies indicate high transmittance close to single crystal sapphire

Transparency as a function of SPS conditions

Status	1	2	3	4	5	6	7	8	9	10

### Major Publications

1. Dibyendu Chakravarty, G. Sundararajan 93, 951-53, 2010, Journal of the American Ceramic Society

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