



## Optical/thermal properties of black alumina

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**Abstract** – Black alumina was fabricated by sintering process. Some optical and thermal properties of the black alumina were measured. The black alumina has black appearance and its absorption spectrum shows high absorption behavior in visible to near infrared wavelength range.

Conventional alumina ceramics have white appearance because they have wide band gap in visible to near infrared wavelength range. In this study, black alumina ceramics have been fabricated by sintering process and light absorption of the material is increased in visible to near infrared wavelength range by introducing absorption levels in the band gap.

Characterization of the sintered material was done by X-ray diffraction analysis, X-ray photoelectron spectroscopy, and scanning electron microscope. In-line light reflectance and total light reflectance of the material was measured in a wavelength range from 250 to 2000 nm. Kubelka-Munk function was obtained from the measured total and in-line light reflectance to estimate light absorption potential of the material. Thermal conductivity and thermal expansion coefficient of the material was measured. Some mechanical properties were also measured. For the comparison purpose, properties of conventional white alumina were also measured.

The sintered material shows black appearance in its color. The material has high light absorption about 90 % in a visible wavelength range and more than 60 % in near infrared wavelength range. The absorption behavior of the black alumina is completely different from the white alumina, indicating that the light is absorbed by introduced absorption levels in the band gap.

Relation between light absorption behavior of the black alumina and its microstructure will be discussed. Based on the measured optical, thermal, and mechanical properties, potential of the black alumina will be also discussed for high temperature environmental application and energy management application.