Thermal Diffusivity of Sintered $12CaO \times 7Al_2O_3$

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Increased attention has recently been paid to the insulating oxide $12CaO \times 7Al_2O_3$ (C12A7), because it can be used for obtaining high purity O^- negative ion emission [1] at a surface temperature of only 800°C and with an extraction field over 1000 V/cm.

Sintered $12CaO \times 7Al_2O_3$ was obtained from $CaCO_3$ and Al_2O_3 powders. They were milled for 120 minutes and the obtained product was pressed at 1000 kg/cm^2 into disks of approximately 10 mm in diameter. The discs were then sintered at 1300°C for 30, 120 and 240 minutes. X-ray analysis of the obtained samples confirmed that during reactive sintering the compound $12CaO \times 7Al_2O_3$ was obtained.

Photoacoustic phase and amplitude spectra of C12A7 sintered pellets were measured using a photoacoustic cell protected against surrounding influence as described elsewhere [2]. The photoacoustic phase and amplitude signals were measured. Thermal diffusivity, coefficient of carrier diffusion, the excess carrier lifetime and the rear and front surface recombination velocities were calculated by fitting experimental spectra and theoretical photoacoustic amplitude and phase signals.

The thermal diffusivity D_T was about 0.3×10^{-6} m^2/s for the samples sintered only in air. The diffusivity doubled when the samples were additionally sintered in hydrogen and finally exposed to UV light.

We feel that the photoacoustic method will also be useful for further characterization of this material, including the possibility to produce C12A7 thin films with a transmission loss of less than 1% in the visible light range [3], which will be essential in the emerging invisible circuit technology [4].

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