**Electrical evaluations of molten lithium borates in microgravity**

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The electrochemical evaluations were carried out on the molten lithium borates with compositions, $x=Li_2O/(Li_2O+B_2O_3)=0.2$, in microgravity condition using the 4.5 sec drop shaft facility in Toki, Japan, for studying the effects of microgravity on the transport phenomenon in the high temperature oxide melt. The variation in the impedance and the phase angle were clearly measured at 100 Hz with 100 mV using a LCR meter in microgravity condition. The electrical potential evaluation at low frequency, 1 Hz, reveals the electrical polarization at the Pt electrodes increases dramatically in microgravity. The convective flow is suggested to effect greatly on the electrical polarization at the electrodes in the molten lithium borates.

Lithium borates are useful crystals for the device applications, (e.g. the surface acoustic wave device (SAW) using $Li_2B_4O_7$, and non-linear optical applications using $LiB_3O_5$). Mass transportations in the viscous melt are essentially important for growing high quality crystals, because the molten borates, from which the crystals were grown, are highly viscous and easily form glass compounds. Microgravity condition is useful for evaluating the transport phenomenon in the melt without the influences of gravity driven convections. The electrical properties of borates in solid and liquid phases have been reported by several authors. However the electrical evaluations of the molten lithium borates in microgravity have not been reported in detail.

In order to examine the transport phenomenon in the high temperature melt, the electrochemical evaluations were carried out on the molten lithium borates with compositions, $x=Li_2O/(Li_2O+B_2O_3)=0.2$, which is a melt composition for the flux growth of non-linear optic $LiB_3O_5$ crystals. Electrical evaluations have been done in microgravity using a drop tube in Micro Gravity Laboratory Japan, (MGLAB). The variation in the impedance and the phase angle were clearly observed in microgravity. The effects of microgravity on the molten lithium borate were discussed based on the electrical polarization at the interface between the melt and the Pt electrodes.

Lithium borates (Tomiyama Pure Chemical Co.) with a composition, x=Li/(Li+B)=0.2, were used as the specimens. The specimens were put on the 20 mm x 16 mm x 5 mm size BN plates with two or three Pt electrodes. Small droplets were formed on the plates. Three BN plates were set into the fused quartz tube. These were then put inside of the furnace. The specimens were heated and melt with the furnace temperatures at 800 and 850 °C. The impedance and the phase angle were measured at the frequencies of 100 Hz and 1 KHz using a LCR meter. Low frequency properties were also measured at 1 Hz using DAQ-1200 PCMCIA card (National Instruments Co.) with the voltage of 100 mV. The droplet shapes were observed using VTR systems attached to the furnace.

Impedance, Z, of specimen increases from 370 to 450 ohm in microgravity condition and decreases suddenly to 300 ohm in 10-G. The phase angle, $\theta$, increases from -75 to 72 degree in microgravity condition and decreases suddenly to -80 degree in 10-G. Based on the Cole-Cole plots of the measurements, the variations in the impedance and the phase angle are suggested to be due to the variation in the capacitance at the interface between the melt and the electrodes in the microgravity.

The cathode voltage increases gradually from -3.0 V to -0.4 V in the microgravity. The anode voltage also increases gradually from 0.4 V to 0.5 V in the microgravity. These phenomena are suggested to be due to the variations in the diffusion layer thickness at the interface between the molten lithium borate and the Pt electrode by the changes in the melt convection in microgravity.

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