TEMPERATURE LIMITS ON COMPATIBILITY OF INSULATING CERAMICS IN LITHIUM* --
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*dedicated to the memory of J. H. DeVan

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EXTENDED ABSTRACT

Calcium oxide and aluminum nitride are candidates for electrically insulating coatings in a lithium-cooled fusion reactor. Bulk specimens of single crystal CaO and polycrystalline AlN+0.04wt.%Y were exposed to lithium in 1000h isothermal capsule tests at 500°-800°C to determine the maximum temperature at which acceptable compatibility is likely. A large increase in mass loss of AlN was observed between 600° and 700°C. At 700°C, the amount of dissolution was reduced when a Mo capsule, which is a less stable nitride former, was used instead of a vanadium alloy test capsule, Figure 1. High mass losses for single crystal specimens of CaO were observed after exposure at 600°C. In this case, changing to a Mo test capsule or adding Ca or O to the lithium did not consistently show a beneficial effect. At 700°C, neither doping the Li with Ca or O significantly altered the high mass losses. These results suggest that CaO may be limited to exposure temperatures of less than 600°C but AlN may be able to operate above 600°C. Because some designs call for operating temperatures of 750°C, other insulator materials, such as Er_2O_3 and Y_2O_3, also are being evaluated. Preliminary results show promise for these oxides after exposure at 800°C, Figures 1 and 2.

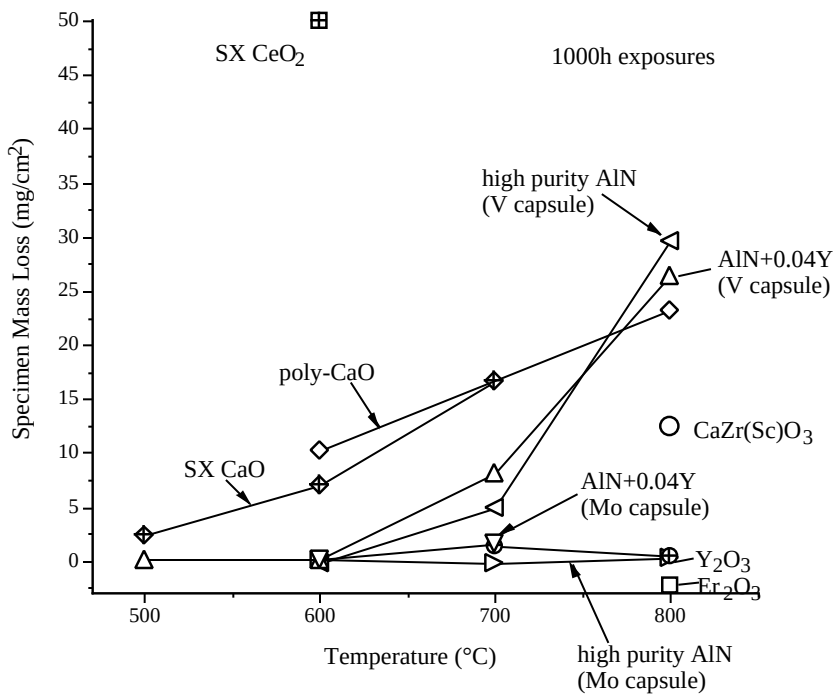

Figure 1. Mass losses for some other oxide materials compared to the data for AlN and CaO after 1000h at various temperatures. The results from poly-crystalline CaO are from previous work.

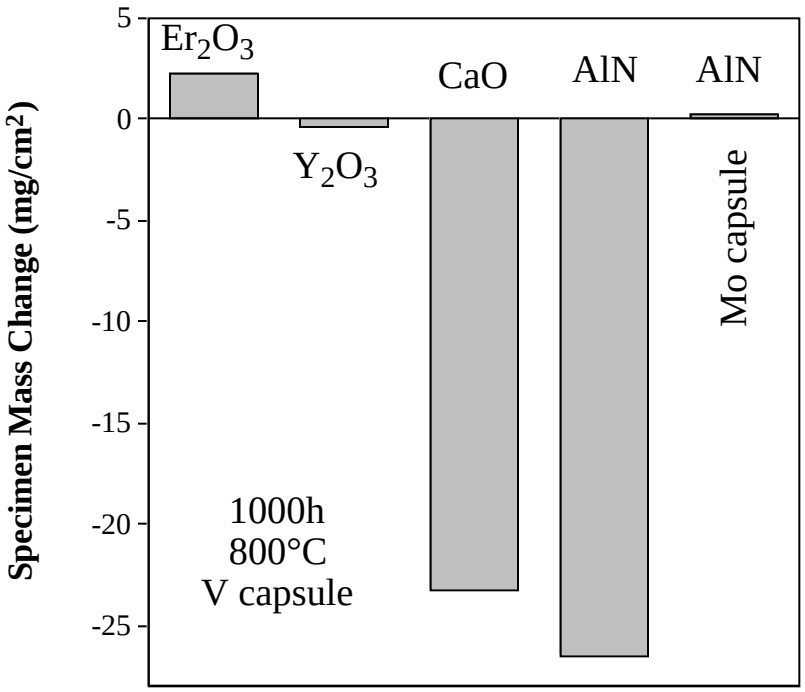

Figure 2. Mass changes for bulk specimens after 1000h at 800°C with V alloy capsules and no additions to the lithium. When AlN was tested in a Mo capsule, there was a slight mass gain instead of a large mass loss with a V alloy capsule.