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SYNTHESIS OF FORSTERITE CRYSTALS

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By means of the flame fusion technique developed to grow synthetic sapphire, crystalline boules of forsterite have been prepared. As far as we know, these are the first synthetic crystals of forsterite of appreciable size to be grown. The boules, up to one and one half inches long, are single crystals during their growth in the Verneuil furnace, but thus far they have developed cracks upon cooling. *X*-ray powder patterns indicate a purity of at least 95% with incompletely reacted periclase and tridymite as the principal impurities. The boules tend to be slightly cloudy in their interiors, probably as a result of the incomplete reaction. The density is 3.26. Work on the crystals will continue, and it is felt that more careful preparation of the feed mix and experimenting with the conditions of growth will greatly improve the quality of the crystals.

Small forsterite polycrystals were first grown using this technique by Bauer and Gordon (1951); the preparation described below started from their work. The feed mix for the furnace was a powder composed of about 90% forsterite, plus uncombined SiO_2 and MgO. It was obtained by reacting dry-mixed powders of ammonium magnesium sulfate, $Mg(NH_4)_2(SO_4)_2 \cdot 6H_2O$, and extremely finely divided pyrogenic silica (Cab-O-Sil) for 10–11 hours at 1400° C. During the heating, water, ammonia and sulfur trioxide are driven off leaving MgO in a more reactive condition to combine with the SiO_2. Shorter heating times or lower temperatures leave a less-reacted powder. Before mixing with the silica the ammonium magnesium sulfate was put through a No. 120 mesh screen, and after the calcining the feed powder was also sieved through a No. 120 mesh. Rather little effort was made to attain a high degree of purity or of stoichiometry beyond allowing a 1.5% excess weight of silica powder to compensate for adsorbed water.

In the furnace the crystals were grown using a Tricone burner and started from a cone built up of sintered powder. The Tricone burner mixes three concentric streams of gases to form an oxyhydrogen flame; the gas flows during growth were in the ratios 1:1:2 for inner oxygen :hydrogen:outer oxygen flow through the burner. Alundum firebrick enclosed the flame and crystal within a $1\frac{1}{2}$ inch diameter cylindrical space.

REFERENCE

BAUER, W. H. AND I. GORDON, (1951) *Jour. Am. Ceram. Soc.* **34**, 250.