Optimizing Thermal Profiles and Stability for Growth of Bulk Crystals in the B2O3-BaO-Na2O System

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The growth of bulk single crystals is crucial for numerous practical applications across various industries. Despite the strong demand driven by the well-developed laser technology industry and scientific research in laser applications, there appears to be a notable gap in research conducted within Lithuania on this crucial topic. To fill this void and make a meaningful contribution to the field, we have undertaken a focused project centered on bulk single crystal growth. We have designed and constructed a two-zone resistive heating vertical tube furnace with a 70 mm internal diameter. This furnace incorporates a seed pulling and rotating mechanism, enabling us to conduct top-seeded solution growth (TSSG) experiments.

Our current research targets the B2O3-BaO-Na2O system, suitable for the growth of barium metaborate crystals. Literature suggests that achieving high axial and radial temperature gradients in the solution is crucial for successful crystal growth.[1] Therefore, we optimized the furnace design to achieve these gradients. By adjusting heater powers in two zones and modifying the furnace cover design, we attained temperature differences of over 20 degrees between the top and bottom of the solution at the center, and over 10 degrees between the center and periphery of the solution at the surface.

Our study investigates temperature stability, vertical temperature distribution (at the center and sides of the crucible), and circular temperature distribution near the crucible wall. We found that the furnace cover design significantly influences stability and temperature distribution. Large opening holes in the cover resulted in unstable air convection, leading to substantial temperature deviations in the melt, while using smaller holes produced more stable conditions.

We will present the results of these measurements, along with initial crystal growth trials, in a poster presentation during the conference.

[1] E.G.Tsvetkov, G.G.Khranenko, V.P.Solntsev, *Journal of Crystal Growth*, **2005**, 275, 2123–2128.

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