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Bulk Single Crystals of Transparent Semiconducting Oxides

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Summary

In this poster, current activities of the Leibniz Institute for Crystal Growth (IKZ) in Berlin, Germany, regarding the preparation and investigation of transparent semiconducting oxide (TSO) bulk single crystals are presented. TSO materials offer impressive properties and thus promising alternatives to existing semiconductor materials. Efficient devices based on crystalline TSOs have potential for commercial application in the fields of power electronics, optoelectronics, photovoltaics, displays, detectors, and sensors. Such devices are prepared by depositing functional layers by vapor phase epitaxy (e.g. MOCVD, MBE, PLD) on single-crystalline TSO substrates, made from bulk crystals.
At the IKZ, we have recently prepared bulk TSO crystals of, amongst others, gallium oxide (β-Ga_2O_3) [1–5], indium oxide (In_2O_3) [3,6–9], tin dioxide (SnO_2) [3,10], magnesium gallate $MgGa_2O_4$ [11–12] and barium stannate (BaSnO3) [13]. A variety of melt and solution growth techniques were employed, SnO_2 was prepared by physical vapor transport. Gallium oxide crystals grown by the Czochralski method are up to 2 inch in diameter and 80 mm long. The other crystals allow for preparation of 5 x 5 mm² or 10 x 10 mm² substrates in all desired orientations with unprecedented structural quality. The growth technology including remaining issues as well as the structural quality, electrical and optical properties are presented. Further details are provided in the references.

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