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Bulk β-Ga_2O_3 single crystals for electronic and optoelectronic applications

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β-Ga_2O_3 belongs to the group of transparent semiconducting oxides (TSOs) showing a unique combination of semiconducting behavior and full transparency in the visible/UV spectrum, as the result of a wide bandgap of 4.85 eV. So far a number of applications have been demonstrated for β-Ga_2O_3 at laboratory scale, including electronic, optoelectronic and sensing devices, such as power transistors, Schottky diodes, visible/solar-blind photodetectors, oxygen and hydrogen sensors as well as photocatalysts. For the applications, bulk single crystals are required which should combine large size, high structural quality and suitable properties, especially when the industrial scale is in quest. This compound is thermally unstable at high temperatures and the growth from the melt requires much scientific and technological attention. In this report the author will focus on the growth of β-Ga_2O_3 single crystals by the Czochralski method and discuss issues associated with the scale-up and in addition, will summarize basic properties and structural quality of the obtained crystals.

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The possibility of producing a stainless magnesium alloy

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Mg alloys are of industrial interest as structural metals due to their low density and high strength to weight ratio. However, the poor corrosion resistance limits their applications. Inspired by the high corrosion resistance of stainless steels, researchers are trying to develop more corrosion resistant Mg alloys. It has been proposed that "stainless" Mg alloys is possible if suitable alloying elements can be added into Mg. This presentation reviews and discusses the possibility of producing a passive magnesium (Mg) alloy through metallurgical approaches, such as purification, alloying, heat-treatment, mechanical processing and non-equilibrium sputter deposition. It shows that high-purity Mg and all existing Mg alloys produced by traditional methods are active in a chloride containing solution. A passive corrosion resistant Mg alloy would require a protective surface film which can self-repair if damaged. Sputter-deposited and rapidly solidified single phase Mg alloys containing supersaturated alloying elements Ti, Ni, Nd, Y and Cu have shown a passivation tendency in a dilute chloride containing solution. Passivity in an Mg alloy might be achieved through a non-equilibrium technique with a sufficiently-high concentration of a strong passivating element supersaturated in the matrix phase. Apart from the clarification of some important concepts regarding passivity of Mg alloys, the presentation also suggests a few possible approaches to develop a corrosion-resistant passive Mg alloy.

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