Can We Grow Single Crystals via. Solid Phase?

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The nonstoichiometric phases of rare earth oxides have been considered to be extremely difficult to grow in a single crystal form because of having high melting point higher than 2,000 °C. Therefore, they usually exist as the mixture of various R_nO_{2n-2m} phases. Here, our novel electrochemical method can simply grow a specific nonstoichiometric phase in a single crystal form even at moderate temperatures less than 1,000 °C, which is fur below the melting point of the oxides. For example, by dc electrolyzing trivalent terbium ion conducting $Tb_2(MoO_4)_3$ solid electrolyte, single crystals of nonstoichiometric terbium oxide phases (R_nO_{2n-2m}) were exactly and artificially grown. The selective growth of a specific phase has been directly demonstrated by controlling the oxygen pressure, and also the electrolysis temperature during the dc electrolysis. By the selected area electron diffraction analysis method, the growth of high-quality single crystals has been clearly identified. In a similar way, the specific phase of aluminum oxide (Al_2O_3) was also grown in a single crystal form at the temperature appreciably below the melting point.

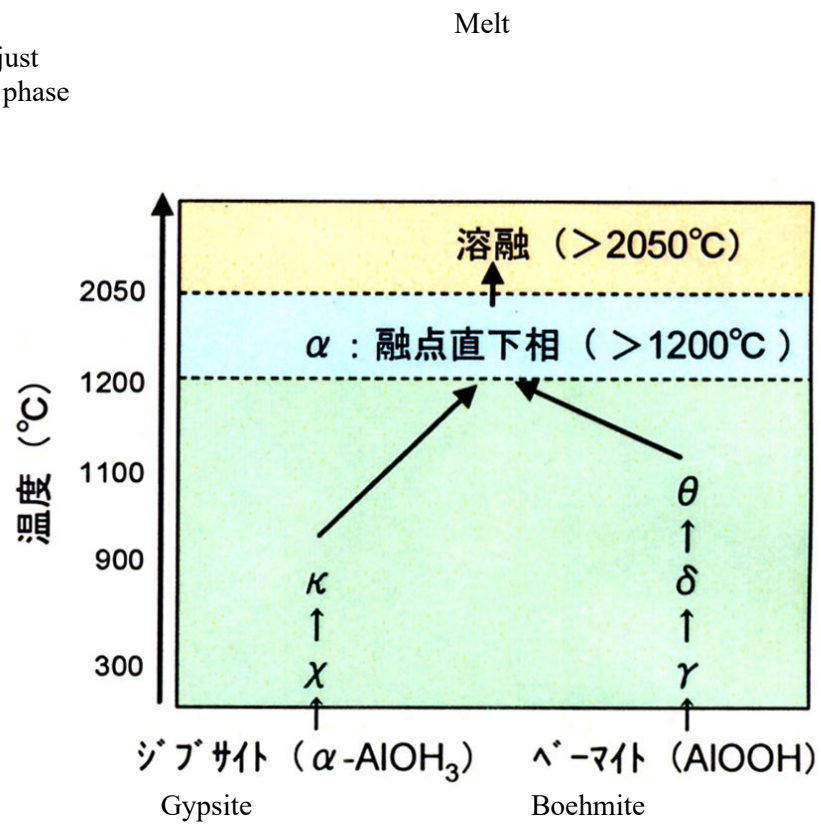

Figure Phase transition of aluminum oxide (Al_2O_3)

References:

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