SYNTHESIS AND MICROSTRUCTURAL PROPERTIES OF UNIFORM A-GAOOH, A-GA2O3 AND B-GA2O3 PARTICLES OF DIFFERENT SHAPES

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Abstract

Five different crystalline forms of gallium oxide (Ga2O3) are known (α, β, γ, δ and ε form). The most investigated modifications are rhombohedral α-Ga2O3 and monoclinic β-Ga2O3. β-Ga2O3 is thermally most stable gallium oxide and this form has found a large number of potential applications. The main gallium oxyhydroxide form is orthorhombic α-GaOOH which is commonly used as a precursor in the synthesis of different gallium oxides. Gallium oxides and oxyhydroxides have been broadly investigated in recent years due to potentially useful catalytic, optoelectronic and gas sensing properties. Besides the crystal structure, the size and shape of metal oxide particles are also important factors that affect their properties and applications. For the better definition of these properties particle uniformity is desirable. In the present work, a new route for the synthesis of uniform α-GaOOH, α-Ga2O3 and β-Ga2O3 particles of various shapes was reported. The method is based on the heating (at 60 or 160 ºC) of the mixture of aqueous solutions of gallium(III) chloride and organic alkali tetramethylammonium hydroxide (TMAH) at various pH values (5, 7 or 9). Nearly uniform α-GaOOH particles of different shapes (spindles, rods, cuboids) were formed in dependence on reaction pH and temperature. α-Ga2O3 and β-Ga2O3 particles of the same shape were obtained by heating at 500 ºC or 1000 ºC, respectively. The samples were characterized by XRD, FT-IR and FE-SEM.

Keywords: α-GaOOH; α-Ga2O3; β-Ga2O3; XRD; FT-IR; FE-SEM

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