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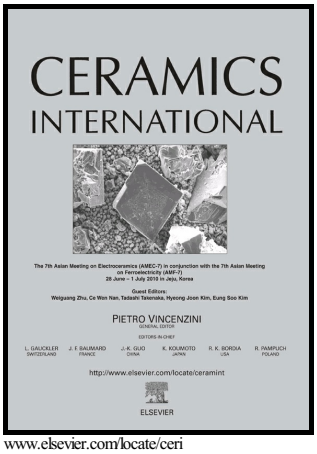
Bikesh Gupta, Pavan Pujar, Sib Sankar Mal, Dipti Gupta, Saumen Mandal



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Retention of high dielectric constant sodium beta alumina via solution combustion: role of aluminum ions complexation with fuel

Bikesh Gupta[a], Pavan Pujar [a,b], Sib Sankar Mal[c], Dipti Gupta[b], Saumen Mandal[a*]

[a]*Department of Metallurgical and Materials Engineering, National Institute of Technology Karnataka (NITK) Surathkal, India.*

[b]*Plastic Electronics and Energy Laboratory, Department of Metallurgical Engineering and Materials Science, Indian Institute of Technology Bombay, Powai 400 076, India.*

[c]*Department of Chemistry, National Institute of Technology Karnataka (NITK) Surathkal, Mangalore, India.*

**Corresponding author: smandal@nitk.edu.in,*

Abstract

In the present study, solution combustion technique has been explored to synthesize Sodium β-alumina (SBA; $NaAl_{11}O_{17}$) powder and thin films. Three fuels namely urea, glycine and citric acid have been used to seek the feasibility of synthesizing crystalline SBA powder at low temperature. Also, the effect of nature of fuels used as well as calcination treatment on phase evolution and morphology of the as-combusted powder was investigated. Thermal analysis and X-ray diffraction studies suggest the formation of crystalline SBA powder at temperature as low as 259 °C, using urea in the combustion reaction whereas other fuels resulted in amorphous SBA phase and this variation in phase was found due to difference in exothermicity of the fuel used. Thermodynamic and spectroscopic analyses showed that the exothermicity of fuel depends on various factors like (i) standard heat of formation of fuel and (ii) the complexation offered by fuel to metal cations. Furthermore, sodium β-alumina thin film capacitor (metal-insulator-metal) was also fabricated using urea via spray combustion synthesis. The sodium β-alumina thin film showed a high dielectric value (ε_r) of ~21.

Keywords: Solution combustion, β-Al_2O_3, Dielectric constant, Capacitor