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Development of New Inorganic-Organic Hybrids by Sol-Gel Process, and its Dielectric Properties

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Development of new organic-inorganic hybrids with high value of dielectric constant has received much current interest for various electronic applications, such as embedded capacitors, multi-layer ceramic capacitors (MLCC), printed circuit boards (PCB), etc. But, it is very difficult to incorporate pre-crystalline ceramic powders ($BaTiO_3$ in particular, which is known to exhibit very high value of dielectric constant) into the organic matrix due to very low dispersibility of the crystalline particles. Therefore, the synthesis of crystalline BaTiO3, highly dispersible in organic medium and then development of new organic-inorganic hybrids there from with high value of dielectric constant is the main focus of this work, which was not explored yet. Crystalline $BaTiO_3$ (70-100 nm) for this work, was synthesized at ~70°C by the reaction between $Ba(OH)_2.H_2O$ and $H_2N(CH_2)_2NH_2$ modified $Ti(OPri)_4$ precursor. Organic-inorganic hybrids with different compositions were prepared by incorporating different proportion of crystalline powder (1-10 wt%) into the partially hydrolyzed 3-methacryloxy propyl trimethoxy silane (MPTS) system and the precursors were deposited on glass substrates by spinning technique (2000 rpm, 20 s). Hybrid films were characterized by XRD, FTIR and SEM and the study of dielectric properties showed that hybrid films exhibited relatively high value of dielectric constants depending on their compositions.

Keywords: Inorganic-organic hybrids, sol-gel, high dielectric

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Inductively coupled plasma reactive ion etching of ZnO using C_2F_6 and BCl_3-based gas Plasmas

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The Inductively Coupled Plasma - Reactive Ion Etching (ICP-RIE) of ZnO using C_2F_6 and BCl_3-based gas plasma was investigated. The surface morphology, etch rate, selectivity and sidewall angle have been studied as a function of pressure, gas flow rate, bias power and ICP power. Nickel was used as an etch mask. It is shown that compared with C_2F_6 and BCl_3-based gas mixtures. C_2F_6 gas were obtained in high etch rate of 410nm/min, vertical sidewall and smooth surface. In the case of BCl_3 Mesas with smooth surface and vertical sidewall were obtained at low bias conditions with a reasonable etch rate of 120nm/min. Efforts to increase the etch rate by increasing the ICP power or the bias power resulted in the trenching effect. As a result of C_2F_6-based gas were obtained etch rate higher than using BCl_3-based gas mixtures.

Keywords: C2F6,BCl3,ICP,etch rate