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Sol-Gel Derived Crystalline $BaTiO_3$ and High Dielectric Inorganic-Organic Hybrid Materials

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Development of new inorganic-organic 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 $BaTiO_3$, 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. Crystalline $BaTiO_3$ (70-100 nm), highly dispersible in organic medium, was synthesized at ~70℃ by the reaction between aqueous $Ba(OH)_2.H_2O$ and acetylacetone or ethylene diamine modified $Ti(OPri)_4$ precursor (Hacac/Ti molar ratio = 3.0) and they were fully characterized by XRD, FTIR, SEM, TEM. As-prepared crystalline particle showed high dispersibility in N-methyl-2-pyrrolidone (NMP) and the precursors for inorganic-organic hybrids were prepared by dissolving calculated amount of soluble polyimide into the $BaTiO_3$ dispersion (solid content: 10-20 wt%, $BaTiO_3$ content = 10-70 wt%). The precursors were deposited on glass substrates by spinning technique (2000 rpm, 20 s). Hybrid films were cured and also characterized by XRD, FTIR and SEM., and the measurement of dielectric properties.

Keywords: BaTiO3, Sol-gel, High Dielectric, Inorganic-organic hybrids

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Conductive Ink for Roll to Roll Gravure Printing 13.56MHz Antenna and Electrodes on PET Foils.

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Conductive inks have been well developed for the last decades to apply in the field of printed electronics. However, there are still major obstacles to use in practical printed electronics. Among the obstacles, curing time of less than 5 sec and temperature of less than 150 °C to attain the typical resistance of 2mΩ/sq/mil, comparable copper etched patterns, need to be first addressed using inexpensive tools. In this presentation, we would like to show optimum R2R gravure printing conditions and ink formulations for printing 13.56 MHz antennas, electrodes and wires on poly(ethylene terephtalate) (PET) foils with the web speed of 4-7 m/min. Furthermore, electrical and mechanical properties of R2R gravure printed patterns will be presented as well.

Keywords: R2R, printing, conductive ink, PET, gravure