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Dielectric Properties of Ceramic/Polymer Composites at Microwave Frequencies

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Effects of particle size, crystal structures and multilayer structures of $ATiO_3$, ATa_2O_6, ANb_2O_6, AWO_4, and $AMoO_4$ (A=Ni, Mg, Zn, Co) ceramic fillers on the dielectric properties of polystyrene (PS), polypropylene (PP) and polytetrafluoroethylene (PTFE) polymer matrices were investigated at microwave frequencies. The microwave dielectric properties of $ATiO_3$ (ilmenite), ATa_2O_6 (tri-rutile), ANb_2O_6 (columbite), AWO4 (wolframite), and AMoO4 (wolframite) ceramics were largely dependent on the structural characteristics of oxygen octahedra. The dielectric constant (K) of the composites was increased with the ceramic content. However, the dielectric loss (tan δ) of the composites was affected by the type of ceramics and the crystallinity of polymers. For the composites with same amount of ceramics, the K was decreased and the tan δ was increased with the particle size of ceramics. Also, the dielectric properties of the composites were dependent on the multilayer structures with different arrangements. Several theoretical models have been employed to predict the effective dielectric properties of the composites. The frequency dependence of dielectric properties and the temperature coefficient of resonant frequency (TCF) of the composites were also discussed.

Keywords: Dielectric Properties, Crystal Structure, Ceramic/polymer Composite,

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Application of Diameter Controlled ZnO Nanowire Field Effect Transistors

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ZnO nanowires have been fabricated by vapor-liquid-solidification with hot-walled pulsed laser deposition method. The diameter of ZnO nanowire has been systematically controlled simply by changing the thickness of Au catalyst. Field effect transistors with different diameter have been fabricated by using photolithography and e-beam lithography. The threshold voltage of ZnO nanowire FET showed enhanced mode and depleted mode depending on the diameter of ZnO nanowires. This is mainly due to the change of the carrier concentration depending on the size of nanowires. We have fabricated ZnO nanowire inverters using nanowire FETs. This simple method to fabricate ZnO nano-inverter will be useful to open the possibility of ZnO nanoelectronic applications.

Keywords: 나노선, ZnO