Microstructures of X7R type base-metal-electroded $BaTiO_3$ capacitor materials prepared by duplex-structured process

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Low temperature coefficient of capacitance (TCC) for the MgO/Y_2O_3 co-doped $BaTiO_3$ materials can be achieved by the duplex-structured process. The results of structure refinement reveal that large amount of MgO species cannot only suppress the grain growth but increase the volume fraction of cubic phase of paraelectric $BaTiO_3$ at room temperature. Investigations of transmission electron microscopy (TEM) indicate that the detailed microstructure is extremely complicated for the $BaTiO_3$ materials. The heavily-doped constituents of the samples remained as fine grains with paraelectric phase, whereas the lightly doped constituents of the materials grew, resulting in a core-shell microstructure via the incorporation of the MgO species when the mixture of the two constituents was sintered. The unique dielectric constant(K)-temperature(T) characteristics of the samples are ascribed to the duplex structure of the samples, which contain fine grains of cubic structure and large grains of core-shell structure.

Keywords: Electron microscopy, Microstructure, $BaTiO_3$, Capacitors, Duplex-structured process.