High Dielectric Constant Samarium Doped Barium Titanate Microwave Ceramics

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Microwave dielectrics in ceramic form have been exploited in a variety of applications ranging from communication devices to the military satellite services. These advanced ceramics have revolutionized RF and Microwave technology. During the past decade, new material compositions developed to suit the stringent requirements for microwave resonators, filters, units of various UHF devices, substrate elements and IC packaging applications. The major advantages of microwave ceramics include the high dielectric constant (ε') and low tangent loss ($\tan\delta$) for stimulating the miniaturization and selectivity of components. The high technology dielectrics with new ideas and designs will be the basis for continuing usage of microwave ceramics in the third generation of Wireless and Telecommunication. This presentation addresses some results of investigations of the dielectric properties and the structure of ceramics based on the $BaO - Sm_2O_3 - TiO_2$ ternary system with dielectric constant greater than 70 and tangent loss less than 0.009. Samples of various compounds with appropriate forms were obtained by the solid-state double sintering synthesis or by chemical co precipitation from salt solutions. The composition x was varied based on $Ba_{6-3x}Sm_{8+2x}Ti_{18}O_{54}$ molecular formula, which has been an extensively used microwave ceramic material. The dielectric properties have been observed as a function of the composition, especially the dielectric constant (ε') and tangent loss ($\tan\delta$) changed non-linearly. The dielectric dispersion has been observed at high frequencies. It has been investigated that the dispersion is basically due to the fact that beyond a certain frequency of the applied electric field the particle exchange does not follow the alternating field.