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Structural and magnetic properties of $Bi_{0.80}Ba_{0.20}Fe_{1-x}Ti_xO_3$ ceramics prepared by planetary ball milling technique

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The $Bi_{0.80}Ba_{0.20}Fe_{1-x}Ti_xO_3$ ($0 \leq x \leq 0.10$) ceramics samples are synthesized by solid state reaction and planetary ball milling technique. The structural, magnetic and electrical properties have been investigated over an wide range of temperature and magnetic field. It is observed that a structural phase transformation has occured for 20% Ba doped BFO. The rhombohedral crystal structure is transformed into a pseudo cubic structure causing a change in the unit cell volume and also that of the nanocrystalite. The FESEM images taken in different magnification shows that the grains are segregated into different clusters with a wide range of size distribution from 100-300 nm. The composition was later doped with Ti to observe the effect of Ti doping on the magnetic and electrical properties of the material.The dc magnetization shows that Ba doped Bismuth Ferrite samples is ferromagnetic with a significant magnetization. However with increasing Ti concentration the magnetization has decreased. The low temperature hysteresis shows diamagnetism for 10% Ti concentration which is regarded as a magnetic phase transition making this composition an interesting material for technological application. It is observed that the highest magnetization is achieved for 20% Ba doped BFO which indicate that there is a possible suppression of long cycloidal spin structure resulting in an enhanced magnetization. The introduction of Ba^{2+} ion at Bi^{3+} site is likely to induce oxygen vacancy which is one of the origins of leakage current. The change in orientation of FeO^6 due to the change of coordination of Fe is also assumed to be another origin of leakage current .We predict that the introduction of Ti^{4+} ion at the Fe site compensates for the oxygen vacancy and reduce the leakage current. In addition the introduction of Ti^{4+} is likely responsible for the increased resistivity of the material. The measured ac dielectric constant, dielectric loss, ac permeability at different temperatures show a strong frequency dependent behavior. The room temperature dielectric constant and dielectric loss factor have shown high values at low frequency and have decreased rapidly with increasing frequency.

Biography

Feroz Alam Khan has completed his PhD degree from the Bangladesh University of Engineering and Technology (BUET) and his Postdoctoral Research at the University of Delaware, USA, University of Uppsala, Sweden, and the University of Tsukuba, Japan. He is a Professor in Physics at the Bangladesh University of Engineering and Technology (BUET). He is a leader of a research group called Dhaka Materials Science Group under a scientific research collaboration with the International Science Programs (ISP), Uppsala University, Sweden. He has supervised more than 25 postgraduate degrees that include Masters, MPhil, and PhD degrees. He has to his credit more than 50 research publications. He is involved in promoting basic science research through the establishment of regional research collaborations with the south-east Asian Universities under the umbrella of International Science Programs.

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