

Project Title: An investigation on the optical and structural characteristics of some ferroelectric materials

Work place/Department: Department of Physics, NIT Raipur

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Summery

There are a lot of perovskite type ferroelectric materials like – BaTiO₃, PbTiO₃, SrTiO₃, BaSrTiO₃, BaZrTiO₃ etc., which show luminescent properties. Among these ferroelectric materials, BaSrTiO₃ (BST) was first synthesized using solid state reaction method, which is low cost and reliable technique and can be used for commercial purpose too. The synthesized samples were characterized by XRD, SEM, FTIR, UV-VIS spectroscopy, etc. The SEM and XRD results revealed the particles to be highly agglomerated and belonging to perovskite type cubic structure. But, cubic phase of BST did not exhibit ferroelectric properties. UV-Vis absorption spectra of BST gave band gap of the order of 4.86 - 5.1 eV, which reveals its insulating nature favouring suitability for thermoluminescence (TL). The investigation of optical properties of BST was performed in terms of mechanoluminescence, thermo luminescence and photoluminescence. After the detailed study of various structural and optical features of barium strontium titanate (BST), it was found that it does not exhibit any extra ordinary optical property as far as thermoluminescence is concerned. Therefore, it was decided to try some other ferroelectric materials with some other impurity. Pure barium titanate (BT) was synthesized and related properties were studied. Barium titanate was doped with La and Pr and its structural (XRD, SEM, EDX, UV-Vis, FTIR spectra) and optical properties ((TL) and (ML)) were studied. The thermoluminescence intensity was found to be satisfactory, as insulator type materials are good candidate for TL phenomena. But ML intensity was not appreciable or even observable, as cubic phase of BT do not exhibit ferroelectric properties. The photoluminescence spectra of pure BT give emission in UV region. Upon doping of La with higher concentration the emission shifts towards visible region.