High-pressure Raman study of $Pb_{0.8}Ba_{0.2}TiO_3$ and $Pb_{0.8}Sr_{0.2}TiO_3$ powder samples

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The study of solid solutions $Pb_{1-x}Ba_xTiO_3$ has attracted attention mainly because the techonological applications of end members. Additionally, although $PbTiO_3$ and $BaTiO_3$ are isomorphous at atmospheric pressure and room temperature (tetragonal 4mm phase), Raman measurements show that for the latter the soft mode is highly overdamped, while for the former, the modes (including the soft mode) are all sharp and underdamped. The study of these materials under high pressure conditions are of interest for several reasons, among them the fact that soft modes are very sensitive to pressure changes and the fact that Curie temperature can be tunable by a combination of pressure and composition changes. It was observed for $PbTiO_3$ (PT) that the $E + B_1$ and the $A_1(2TO)$ bands have a separation of ~ 50 cm^{-1} at atmospheric pressure and become only one band when pressure is close to 5 GPa. Here we investigate the effect of high-pressure on the Raman spectra of $Pb_{0.8}Ba_{0.2}TiO_3$ (PBT) and $Pb_{0.8}Sr_{0.2}TiO_3$ (PST). We observed that for the materials PBT and PST the difference in energy of the $E + B_1$ and $A_1(2TO)$ is lower than 50 cm^{-1}. This point to the fact that Ba and Sr ions are playing roles similar to that of pressure. So, the stoichiometric impurities Ba and Sr produce a "chemical pressure" on the PT matrix. Increasing the pressure, we observed that the bands of the Raman spectra of PBT and PST have behaviors similar to those observed for PT. We were also able to give dw/dp, fundamental to determine the Mode - Grunmeisen parameter of all modes of PBT and PST.