Griffiths phase manifestation in \((Pb,Sn_{1−γ})_2P_2S_6\) ferroelectrics

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Ferroelectric instability in \(Sn_2P_2S_6\) crystals is a result of non-linear coupling of soft polar and fully symmetrical optic modes, leading to three-well potential\(^1\). Such system can be described by two order parameters that are related with dipole and quadrupole moments, and as a result stable and metastable ferroelectric and paraelectric states can be realized. The Blume-Emery-Griffith model could be used in combination with ANNNI model\(^2,3\) for the description of temperature - pressure - concentration phase diagram of \(Sn_2P_2(Se_xS_{1−x})_6\) crystals with incommensurate phase. In the \(Sn_2P_2S_6\) crystals under compression existence of tricritical point is expected. At higher pressure beyond the tricritical point the presence of metastable states is possible. Recent data\(^4\) of the neutron diffuse scattering in \(Sn_2P_2S_6\) crystal in the vicinity of the phase transitions at high hydrostatic pressures, as well as Monte Carlo simulation of its \(p − T\) diagram, give evidences of pressure induced metastable states formation near \(p \approx 0.6\) GPa. For \((Pb,Sn_{1−γ})_2P_2S_6\) mixed crystals the tin by lead substitution increases ionicity of chemical bounds what is similar to hydrostatic pressure influence. Possibility of the Griffiths phase appearance in \((Pb,Sn_{1−γ})_2P_2S_6\) crystals with diluted ferroelectric sublattice is investigated. The ultrasound velocity and attenuation peculiar behavior is compared with hypersound characteristics on Brillouin scattering data and with results of dielectric measurements.