

Synchrotron anomalous X-ray scattering and electrical resistivity analysis on granular (Hg,Re)-1223 superconductors

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Hg,Re-1223 polycrystalline samples were prepared with different three oxygen partial pressure. The Rietveld refinement of the XRD measurements have shown that the better spectrum fit was obtained including an extra Hg-1223 phase (poor oxygen) additionally to the main (Hg,Re)-1223 phase (rich at oxygen). The lattice parameter a has indicated that the extra Hg-1223 phase is under doped (poor at oxygen). Scanning Electron Microscopy (SEM) images and Energy Dispersion X-ray Spectra (EDS) analysis were done. The results have shown that the samples have similar morphology of the grains and average junction sizes. Moreover, the intergrain region of samples were investigated by ac magnetic susceptibility (χ_{ac}) using these samples in pellet form. The results indicated that the in-phase component χ'_{ac} of the ac susceptibility has two transitions towards lower diamagnetic screening. As intergrain morphologies are similar for all samples, the second transition in χ'_{ac} susceptibility is associated with the presence of Hg-1223 phase on grain boundary. It is known that the HTSC exhibit complex behavior, which is related to thermodynamic fluctuations of the superconducting order parameter. For the polycrystalline samples case there are two models which can give a picture of fluctuations in intergrain and intragrain regions. Therefore, dc electrical resistivity of the samples was measured using the four-point probe method. The analysis of these measurements was possible to estimate single crystal average size, which was order of 1500 Å.