Phase Transitions in S-Doped InP under High-Pressure Studied by Angular-Dispersive X-ray Diffraction Method

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Because the difficulty of preparing zinc heavy dopant of Gallium Arsenic (GaAs:Zn) sample. We continue the InP:S works. The pressure effect on the phase transitions of S-doped indium phosphide (InP:S) at ambient temperature has been investigated using angular-dispersive X-ray diffraction (ADXD) and Raman scattering under high pressure up to around 45.0 and 38.0 GPa, respectively. In situ ADXD measurements found that the transition of InP:S to a rock-salt phase began at 10.4 GPa and completed at 13.3 GPa with a 15.7% volume decrease. Another transition to the *Cmcm* phase was found to occur at 35.8 GPa with a 4.1% volume decrease. The fitting of volume compression data to the third-order Birch-Murnaghan equations of state yielded that the zero-pressure isothermal bulk moduli (B_0) and the first-pressure derivatives $\left(B_0'\right)$ were 74 GPa and 3.9 for the zinc-blende phase, 92.2 GPa and 4.3 for the rock-salt phase, and 100.2 GPa and 1.0 for the *Cmcm* phase, respectively.

Figures 1 and 2 show representative X-ray diffraction and standard pressure lines of internal gold (111) and (200) patterns for the zinc-blende structure (B3 phase) of InP:S up to 9.6 GPa and a mixture of zinc-blende structure (B3 phase) and rock-salt structure (B1 phase) up to 13.3 GPa, respectively. Figures 3 and 4 show representative X-ray diffraction and standard pressure lines of internal gold (111) and (200) patterns for the rock-salt structure (B1 phase) up to 33.8 GPa and *Cmcm* structure up to 44.6 GPa, respectively. Figure 5 shows volume vs. pressure data measured at the ambient temperature for InP:S.

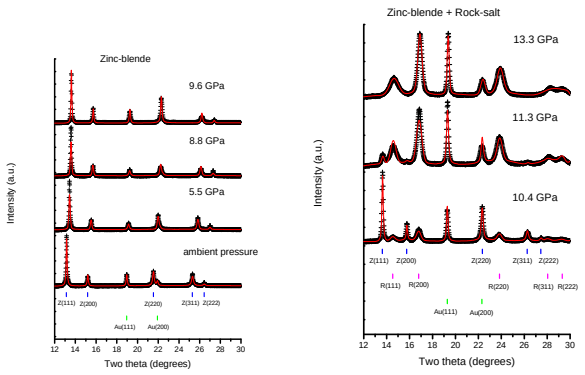

Figure 1. X-ray diffraction patterns of the InP:S sample in the zinc-blende phase measured at selected pressures and ambient temperature and processed by the Rietveld method in a loading run up to 9.6 GPa. Experimental points and calculated profiles are shown. The spectra include the diffraction peaks of the gold particles in the sample.

Figure 2. X-ray diffraction patterns of the InP:S sample in a mixture of the zinc-blende and rock-salt phases measured at selected pressures and ambient temperature and processed by the Rietveld method in a loading run up to 13.3 GPa. Experimental points and calculated profiles are shown. The spectra include the diffraction peaks of the gold particles in the sample.

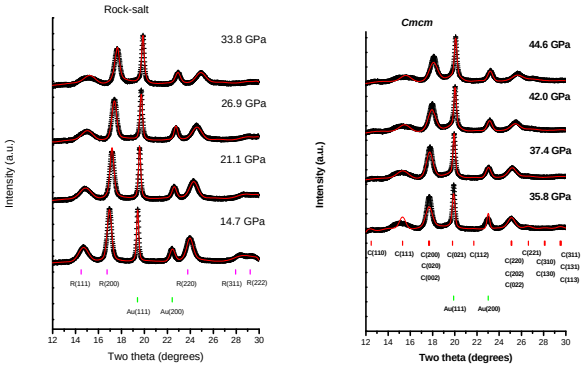

Figure 3. X-ray diffraction patterns of the InP:S sample in the rock-salt phase measured at selected pressures and ambient temperature and processed by the Rietveld method in a loading run up to 33.8 GPa. Experimental points and calculated profiles are shown. The spectra include the diffraction peaks of the gold particles in the sample.

Figure 4. X-ray diffraction patterns of the InP:S sample in the *Cmcm* phase measured at selected pressures and ambient temperature and processed by the Rietveld method in a loading run up to 44.6 GPa. Experimental points and calculated profiles are shown. The spectra include the diffraction peaks of the gold particles in the sample.

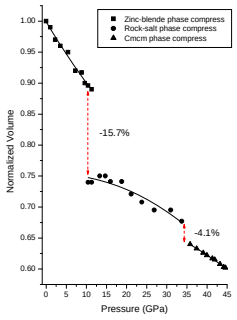

Figure 5. Volume vs. pressure data for InP:S upon compression at ambient temperature.