

Investigation of pressure induced crystal-crystal phase transformations in α - AlPO_4 prior to amorphization

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α - AlPO_4 which exists in α -quartz structure at ambient conditions has been shown to become amorphous under high pressures and shows memory effect under pressure unloading^{1,2}. Recent Raman scattering experiments have suggested that a crystal-crystal phase transformation may precede amorphization³. Our recent molecular dynamics calculations⁴ have shown that this material does not fully amorphize even at 40 GPa. However at about 12-15 GPa, this material is predicted to undergo a subtle phase transformation associated with a partial disordering of oxygen atoms⁴. To ascertain whether α - AlPO_4 undergoes a crystal-crystal phase transformation as well as amorphization at high pressures, diamond anvil cell based x-ray diffraction experiments were carried out at beamline BL10XU of SPring-8.

Observed variations in the diffraction pattern under pressure are shown in Fig. 1. The values of lattice constants obtained with refinement of 13 diffraction peaks agree very well with those available from earlier experiments upto 8 GPa⁵. Our preliminary analysis of experimental results indicate that α - AlPO_4 undergoes a subtle phase transformation at 12-15 GPa as is indicated in the variation of c/a shown in Fig. 2. Further the persistence of diffraction peaks even beyond 30 GPa suggest that this material does not fully amorphize at 20 GPa or so as had been claimed in earlier experimental studies^{1,2}. Detailed analysis of the experimental results is in progress.

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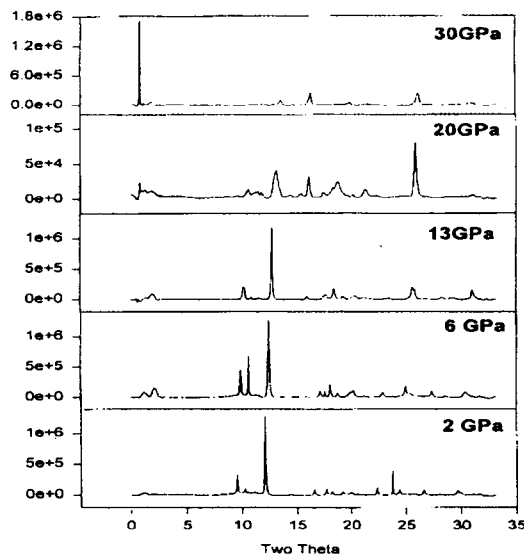


Fig. 1 Diffraction pattern of α - AlPO_4

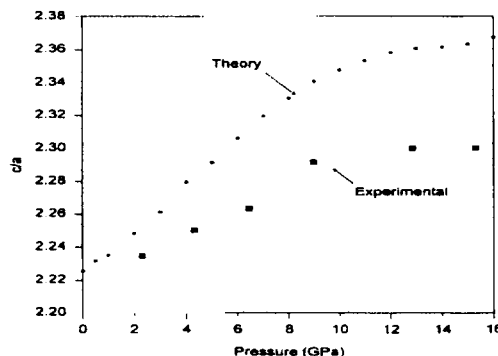


Fig. 2 c/a variation with pressure

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4. Nandini Garg and S.M. Sharma, communicated for publication
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