Inelastic neutron scattering under high pressure

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The talk reviews results on phonon dispersion measurements to 15 GPa obtained by inelastic neutron scattering. The tenfold increase in pressure achieved in such neutron studies is a major progress in triple axis spectroscopy on reactor sources. It allows determining accurately the phonon frequencies of a variety of solids over a wide pressure range [1-6]. We will illustrate the potential of this technique by two examples: the pressure-induced phonon softening is $AgGaSe_2$ to 6 GPa [6] and the mode softening of FeO (wüstite) to 15 GPa [4]. $AgGaSe_2$ is a semiconductor with chalcopyrite structure at ambient conditions which transforms at ~3 GPa to a slightly distorted monoclinic phase. We show that this transition is accompanied by an exceptionally strong variation of the TA branches, a pressure effect which was confirmed by ultrasonic measurements. FeO crystallises at 0 GPa in a paramagnetic NaCl structure and converts at 15 GPa to a rhombohedrally distorted antiferromagnetic phase. We have studied the pressure-induced frequency shifts in the NaCl phase up to 15 GPa, in particular the TA branch associated to C_{44}. The findings will be compared to published ultrasonic measurements and results from x-ray studies. The foreseeable limits of this technique will be discussed as far as pressure and data quality are concerned.

References

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