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The Martensitic Transformation in In-Tl Alloys Revisited

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The traditional, “text-book” view [1] for the martensitic transformation in In-x at%Tl alloys, for 15.5 x 30.5, has been via a double shear such as: (101)[1 01]; (011)[01 1], on the basis of optical - microscopy observations [2] and measurements of the $(c_{11} - c_{12})/2$ elastic constant [3]. However, this model was called into question following measurements of the low-, [0][0] phonons, initially on the HB3 triple-axis spectrometer at the Oak Ridge National Laboratory [4], on the H7 spectrometer at Brookhaven National Laboratory [5] and more recently, at the Australian Centre for Neutron Scattering (ACNS), via Proposal DB6030, on the Sika cold-triple-axis spectrometer at the OPAL Research Reactor [6]. An alternative model for the formation of coherent nuclei and growth along conjugate {111} planes was once proposed by Geisler [7]. This model is consistent with some electron diffraction diffuse scattering data [8] as well as yielding identical x-ray pole figure results as those for the double-shear mechanism [7], where appropriate nuclei could be generated by $\langle 111 \rangle \langle 112 \rangle$ atomic displacements. To test such an idea we have measured the []T phonon branch as a function of temperature, for a good quality, In-Tl crystal through ACNS proposal P7049, also on the Sika spectrometer. In addition, we are undertaking resonant ultrasonic spectroscopy (RUS) and transient grating spectroscopy (TGS) measurements on small crystals of In-Tl, which we have shown to exhibit the martensitic transformation, through a recent experiment on the Koala Neutron Laue Diffractometer at OPAL via ACNS proposal DB17489. The results of these various experiments will be presented and discussed, in relation to the traditional view for the transformation in In-Tl alloys.

References

- [1] G.A. Chadwick. Metallography of Phase Transformations (Butterworths, London, 1972) p272.
- [2] J.S. Bowles, C.S. Barrett and L. Guttman. “Crystallography of Cubic-tetragonal Transformation in the Indium-Thallium System”, Trans. Metall. Soc. A.I.M.E. 188, 1478-1485 (1950).
- [3] D.J. Gunton and G.A. Saunders. “The Elastic Behaviour of In-Tl Alloys in the Vicinity of the Martensitic Transformation”. Solid State Commun. 14, 865-868 (1974).
- [4] T.R. Finlayson and H.G. Smith. “Neutron Scattering Studies of Premartensitic Indium-Thallium Alloys”, Metall. Trans. A 19A, 193-198 (1988).
- [5] T.R. Finlayson, D. Donovan, J.Z. Larese and H.G. Smith. “Studies of Transverse Phonon Modes in Premartensitic Indium-Thallium Alloys”. Materials Science Forum 27/28, 107-112 (1988).
- [6] T.R. Finlayson, G.J. McIntyre and K.C. Rule. “The Martensitic Transformation in Indium-Thallium Alloys”. Proceedings of the International Conference on Martensitic Transformations: (Chicago), eds. Aaron P. Stebner and Gregory B. Olsen (ISBN 9789-3-319-76968-4) (The Minerals, Metals & Materials Society, 2018) pp 291-297.
- [7] A.H. Geisler. “Crystallography of Phase Transformations”. Acta Metall. 1, 260-281 (1953).
- [8] T.R. Finlayson, P. Goodman, A. Olsen, P. Norman and S.W. Wilkins. “An Electron Diffraction Study of a Pre-martensitic In-24 at.% Tl Alloy”, Acta Cryst. B40, 555-560 (1984).

Topics

Magnetism and Condensed Matter

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