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12-Amorphous, Imperfectly Ordered and Quasi-periodic Materials

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STRAIN-INDUCED STACKING FAULTS IN INTERSTITIAL SOLID SOLUTIONS.

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The method of statistical-thermodynamic description of the strain-induced stacking faults distribution in ordered interstitial solid solutions is developed within the framework of lattice statistics approach. Long-period stacking order in interstitial superlattice is considered.

Formation of the equilibrium stacking faults structure in interstitial solid solutions based on hcp metals is studied. It is determined in accordance with experimental results [1] that for the case of α Zr-O solid solution the stacking faults of two types are arranged periodically and the period of stacking order varies due to temperature and concentration changes, contrastingly, for the case of α Ti-O solid solution only one type of antiphase faults is possible and irregular antiphase domain boundaries with "Swiss-cheese" type are taking place.

The correct accordance of theoretically predicted and experimentally observed interstitial stacking fault structures lends support to the validity of assumption about the strain-induced nature of the stacking faults distribution in interstitial alloys.

1. M. Hirabayashi, S. Yamaguchi, H. Asano, K. Hiraga, *Reine und angewandte Metallkunde in Einzeldarstellungen*. 24, p. 266 (1974).

of higher polytypes, with moderate occurrence of streaking and arcing. The hexagonal platy crystals obtained from solution growth exhibited more frequent occurrence of various polytypes (particularly 2H), with strong streaking on their X-ray photographs. The X-ray photographs of melt grown crystals showed the presence of polytype 4H alone, but unlike the vapour grown dendritic crystals the streaking and arcing were observed in many cases. The formation of various polytypes can be explained as arising from the arrangement of stacking faults in the structure under favourable thermodynamical conditions. The exclusive presence of 4H and the absence of streaking in vapour grown dendrites bring about the remarkable fact that in spite of the relatively high rate of growth under which dendritic crystals are known to grow, the stacking faults had been negligibly created. The fact that the crystals grown from vapour phase in two different habits, viz. dendrites and hexagonal plates, display different polytypism confirms that the phenomenon of polytypism is governed by crystal habit, too, as found earlier for the polytypic compounds GaSe & AgI [TERHELL, J.C.J.M. (1983). In *Crystal Growth and Characterization of Polytypic Structure*, edited by P.KRISHNA, p.55-109, Pergamon Press; PRAGER, P.R., *ibid.*p.450-491]. The observed difference in the nature of polytypism exhibited by the CdI₂ crystals grown by different growth processes may be attributed to the difference in growth conditions, mainly those relating to temperature and rate of crystallization.

PS-12.01.35 VARIATION IN THE POLYTYPISM OF CADMIUM IODIDE CRYSTALS GROWN BY DIFFERENT METHODS. BY BINAY KUMAR & G.C. TRIGUNAYAT*, Department of Physics & Astrophysics, University of Delhi, Delhi-7 (INDIA).

Cadmium iodide is known to be a richly polytypic compound, with nearly 200 CdI₂ polytypes of known crystal structure. Single crystals of cadmium iodide were grown by us employing three different methods, viz. vapour, solution and melt. The material was highly purified by zone refining technique before employing for crystal growth.

Dendritic crystals were grown by vapour deposition process in an evacuated quartz tube [KUMAR, B. and TRIGUNAYAT, G.C. 1991, *Acta Cryst.* A47, 263-267]. The dendrites exhibited well developed morphology, with their stems and arms extending along crystallographic directions. Employing a different temperature profile, hexagonal platy crystals were also grown with the same experimental set-up. Hexagonal platy crystals were grown from solution, too. For melt growth of the crystals, Bridgeman Stockbarger method was employed.

The crystals were studied for their polytypism and related phenomena by x-ray diffraction. The vapour grown dendritic crystals were exclusively found to be of the four-layered hexagonal type 4H, which is known to be the most common CdI₂-polytype. The phenomenon of streaking was not observed at all. The phenomenon of arcing was observed in just about 12% cases. The vapour grown hexagonal platy crystals showed the occurrence

PS-12.01.36 THE GENERIC RELATIONSHIPS BETWEEN QUASICRYSTALS AND SIMPLE CRYSTALLINE STRUCTURES. By V.E.Dmitrienko, Institute of Crystallography, Moscow, 117333 Russia.

It is shown that the local atomic ordering in the icosahedral quasicrystalline alloys (Al-Li-Cu, Al-Mn-Si, Al-Fe-Cu, etc.) is closely connected with the familiar crystalline structures (CsCl-B2, Hg-A10 and FeSi-B20). The most of atomic configurations in the quasicrystals and in their large approximants can be considered as the ordered pieces of those simple structures. Formally, all such configurations are described within the model of the dodecahedral local ordering (V.E.Dmitrienko, *JETP Letters*, 1992, 55, 391-395; *J. Non-Cryst. Solids*, 1993, to be published; *J. Phys. France*, 1993, submitted). In this model, each atom is surrounded by the neighbouring atoms positioned at several vertices of a small pentagon-dodecahedron. Because of the finite atomic radii, only a few vertices of this coordination dodecahedron can be simultaneously occupied around each atom (8 at maximum); however, on average, all 20 vertices of the coordination dodecahedron have the same occupation (in the quasicrystals, but not in the approximants). Unusual projection scheme is used for the construction of the hierarchially ordered structures. Possible physical reasons for the dodecahedral local ordering of real atoms are discussed.