

07.2-7 CRYSTALLIZATION PROCESS AND NEW CRYSTALS IN SOME NON-CRYSTALLINE Mn ALLOY FILMS PREPARED BY VACUUM CODEPOSITION, By K. Yoshida and T. Yamada, Faculty of Engineering, Kobe University, Rokkodai, Nada, Kobe 657, Japan

Several Mn alloy films were prepared by simultaneous vacuum deposition from different sources. Some of them show diffuse halos in the as-deposited state. Their crystallization process and structures of produced crystals were investigated by electron microscopy.

In the case of Mn-Al system (J. Phys. Soc. Japan (1972) 32, 431, Thin Solid Films (1978) 48, 293), the process is remarkably different depending on the film composition. For 100-35 at% Mn, the films show only grain coarsening as the temperature is raised. Thus produced crystals have the same structures as those of the stable alloy phases at the corresponding composition. For the film of 28 % Mn, nuclei of crystals appear separately and grow into leaf-like forms eating out the matrices at their peripheries. They show heavily streaked diffraction patterns and its structure was determined to be a one-dimensionally disordered  $\delta$ (Mn-Al) structure, which is the stable one at the same composition. For 21-15 % Mn, the films crystallize in the similar "nucleation and growth" mode, but into various forms. The form changes from circular, leaf-like and to avalanche shape as the composition decreases. One of thus obtained crystals is presumed to have an inverted  $MnAl_6$  structure.

In contrast to the above result, Mn-Bi films show a peculiar behavior (J. Cryst. Growth (1978) 45, 376, *ibid* (1982) 58, 229). The films show halos only when their composition is in a range 65-80 % Mn. They crystallize in the "nucleation and growth" mode into leaf-like forms. They are, however, unable to be identified as any one of the reported alloy phases of the system. From its diffraction patterns, its crystal lattice was determined to be hex.  $a = 19.97 \text{ \AA}$ ,  $c = 4.49 \text{ \AA}$  slightly changing as the composition changes. This new crystal is metastable since it transforms quickly into the superlattice of the quenched high temperature phase of the ferromagnetic MnBi phase when the temperature was further raised.

Mn-Sb system also shows a different behavior. We have had a clue suggesting that a new crystal with a very long period of about 20  $\text{\AA}$  appears as a crystallization product.

Method of the film preparation, results of the observations by high resolution electron microscopy and of the structure analyses will be presented.

07.2-8 A PARTICULAR ROLE OF MULTIPLY-TWINNED PARTICLES IN EPITAXY. By Yasukuni Ohtsuka, Department of Physics, Tohoku Institute of Technology, Kasumicho, Yagiyama Sendai 982, Japan

Introduction - When thin films are formed through the nucleation and growth, epitaxy has two stages, a stage of particles and continuous film. Epitaxy of particles is distinguished from epitaxy of continuous films by the orientation of overgrowth on a substrate.

Multiply-Twinning Particles (MTP's) were found at first to be formed on the ionic crystal substrate, and then on the amorphous carbon substrate. They were also reported to be formed in argon at low pressure. It seemed that MTP's had nothing to do with epitaxy.

We have investigated the epitaxy of particles in the cases of Au-NaCl and Ag-NaCl system under ordinary high vacuum. The following results have been obtained:

(Au-NaCl system) MTP's play a role of epitaxial particles in spite of their particular structure, and MTP's are formed even at a substrate temperature which is lower than the random-(111) transition temperature that is found by the (111) lattice image observation. These results denote that MTP's are "quasi" epitaxial particles.

(Ag-NaCl system) Ag particles before coalescence are MTP's at the substrate temperature at which the orientation of continuous films become (100) orientation. A large particle after coalescence of MTP's of (111) orientation, has been found to be of (100) orientation. It may be concluded that the orientation of a continuous film of Ag is determined by recrystallization after coalescence of MTP's.

References: K. Mihama and Y. Yasuda; J. Phys. Soc. Japan 21 (1966) 1166. S. Ino; J. Phys. Soc. Japan 21 (1966) 346. T. Komoda; Lecture at the Meeting of the Japan Soc. Appl. Phys. held in 1967. K. Kimoto and I. Nishida; J. Phys. Soc. Japan 22, 1967.