07.2–4 CRYSTALLIZATION STUDY OF Ta-Si THIN FILMS WITH TIME-RESOLVED X-RAY DIFFRACTION AT HIGH TEMPERATURES.

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The crystallization behavior of co-sputtered Ta-Si thin films on Si (100) wafer substrates was studied by time-resolved X-ray diffraction at different temperatures. The system (H.E.Göbel, Adv.in X-Ray Analysis 24 (1981), 187-195) uses a position sensitive proportional counter as a multichannel detector for the simultaneous recording of changes of diffraction peaks by a multiplex data storage. Samples of different Ta-Si ratios around the composition $TaSi_2$ were investigated with and without an interlayer of SiO_2 as diffusion barrier between the substrate and the Ta-Si film. The formation of $TaSi_2$ from the amorphous starting state after sputtering was traced at constant time intervals with increasing temperature. Two stages in the formation process can be observed: already at 350-400°C the formation of microcrystalline $TaSi_2$ begins, whereas at about 750°C a rapid recrystallization takes place, coupled with a strong preferred orientation. While in the first stage, a certain stoichiometric range seems permissible, the second stage requires the strict $TaSi_2$ composition. In Ta-rich films, at this stage, the deficit of Si is supplied by diffusion of Si from the substrate if there is no SiO_2 interface. With an interface, the precipitation of Ta_5Si_3 is observed as an additional phase (Fig.1). The influences of stoichiometry and the presence or absence of an interlayer on the recrystallization temperature and the degree of preferred orientation were studied in detail.

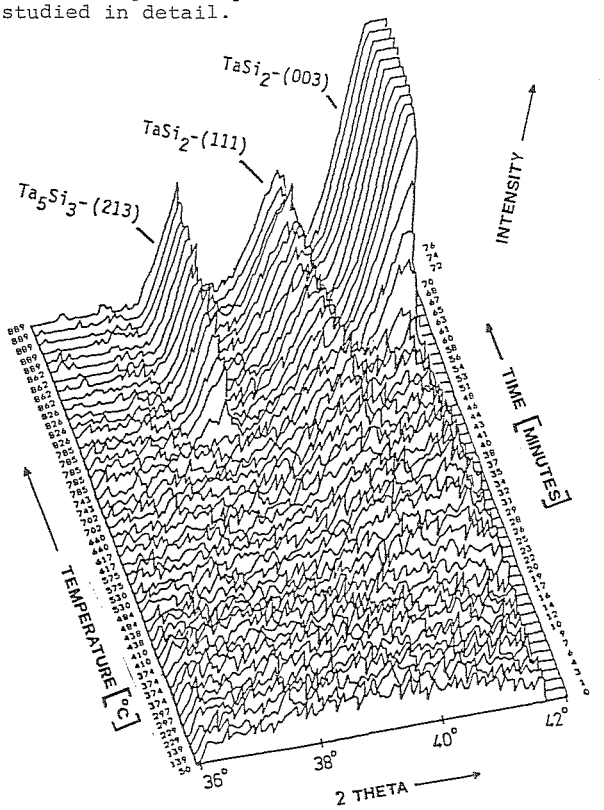

Fig.1: Crystallization in a Ta-rich sample on a gate-oxide interface layer.

07.2–5 PENETRATION OF D_2O MOLECULES INTO THE SURFACE LAYER OF LiF SINGLE CRYSTALS DURING THEIR DEFORMATION IN THE HEAVY WATER MEDIUM. By O.V.Klyavin, G.I.Shvets and A.G.Banshikov, A.F.Ioffe Physikotechnical Institute of Sciences, Leningrad , USSR.

The problem of the interaction between the mechanically activated surface of a solid and the surrounding medium through the activation centres - the mobile dislocations has been considered (O.V.Klyavin, B.A.Mamyrin, L.V.Habarin, V.S.Yudenich, Fizika Tverdogo Tela (1976) 18, 128; (1982) 24, 2001). For the first time, it is proved experimentally that the mechanism of the dislocation-dynamic diffusion (DDD), the phenomen of the penetration of the ambient medium components into crystalline materials during deformation, takes place at room temperature. The experimental data have been obtained on LiF single crystals which were deformed in compression by a single slip method in the heavy water medium. By means of SIMS method it is shown that the penetration depth as well as D_2O molecule concentration in the edge glide bands is several times larger than the screw ones, while the absorption of D_2O molecules by dislocations is mainly controlled by the dislocation mobility itself, but not by the dislocation density increase during the crystal deformation. Intrduction of D_2O molecules into LiF crystals by plastic deformation leads to the improvement of the strength characteristics of the crystal surface layer which exerts a considerable influence on the macro-mechanical properties of the crystals. A possibility appears to control these properties due to crystal deformation in the media of different types both increasing and reduction the dislocation density in the surface layer, which is of great importance in practice.

07.2–6 THE STRUCTURE AND ORIENTATION OF $Cd_{1-x}Mn_xTe$ FILMS ON ROCKSALT SUBSTRATES. By S. Miotkowska, I. Miotkowski and T. Warminski, Institute of Physics of the Polish Academy of Sciences, Al. Lotnikow 32/46, Warsaw, Poland.

Thin $Cd_{1-x}Mn_xTe$ films were obtained by vacuum evaporation using a hot-wall technique. The films were deposited in quasi-closed cell on rocksalt with substrate temperature ranging from 300 to 600° C and with various degrees of supersaturation and different gas phase composition. Conventional bright field TEM(BF), TED and TEM(DF) was used to study the structure and orientation of films of various thicknesses. Discontinuous growth and the morphology of early growth have been observed. In the early stage of growth the films consisted of the epitaxial islands and non-epitaxial islands. The epitaxial islands made the small squared shape cubic crystals which had (001) plane parallel to the substrate and triangular shape crystals which had (011) plane parallel to the substrate. The non-epitaxial islands were multiply-twinned crystals. In the next stage of growth small crystals touch to each other and coalescence by surface diffusion to form large crystals which are generally free of twins. The perfection of the structure of the final continuous films was determined by the coalescence process of large crystals in which most of the faults were generated.