07.2–1 ON THE CRYSTALLINITY AND TEXTURE OF DOPED AND UNDOPED STANNIC DIOXIDE THIN FILMS.

By M. Fantini and I.L. Torriani, Instituto de Física, Universidade Estadual de Campinas, Campinas, S.P., Brazil.

High stability, transparency and conductivity are some of the properties that have made tin dioxide one of the most promising materials in the field of photothermal and photovoltaic solar energy conversion devices. Consequently, the optical and electrical properties of tin dioxide thin films undoped and doped with elements of groups III (In), V (Sb) and VII (Cl,F), have been the object of extensive research. The results published are, though, quite diverse in nature. This is principally due to the structural characteristics of the films, which depend on the substrate nature and the deposition method used.
A systematic study has been undertaken in our laboratory, using X-ray diffractometry to investigate the crystallinity and texture of undoped stannic dioxide films as functions of deposition temperature for four different substrates, and of fluorine doped stannic dioxide films as functions of dopant concentration in the spraying solution. Our results showed that the crystallinity of the films depends not only on the deposition temperature, but also on the nature of the substrate. Preferential orientation, noted for all polycrystalline films regardless of substrate nature was in the (200) direction.
In the case of the doped films, the incorporation of fluorine was confirmed by SIMS (Secondary Ion Mass Spectroscopy). X-ray analysis of the samples showed that the preferential orientation of the films continued to be in the (200) direction. The only change brought about by the presence of fluorine in the SnO_2 lattice seems to be a systematic increase in the intensities of the (110) and (101) reflections with increasing fluorine concentration.

Research sponsored by CNPq and SUBIN.

07.2–2 CRYSTALLOGRAPHIC PRINCIPLES OF ARTIFICIAL EPITAXY AND ITS INTERRELATION WITH CLASSICAL EPITAXY.

By N.N. Sheftal and E.I. Givargizov, Institute of Crystallography, USSR Academy of Sciences, Moscow 117333, USSR.

Artificial epitaxy (or graphoepitaxy), i.e. oriented crystallization on amorphous substrates having a crystallographically-symmetrical microrelief has been developed during last decade as a new approach to crystal growth [1,2]. This approach is of great importance for both science and technology.
In science, the artificial epitaxy generalizes ideas of the classical one proving a role and mobility of small crystallites in addition to those of atoms or molecules in crystallization and underlining role of symmetry factors in epitaxy.
In technology, the artificial epitaxy serves as an effective alternative to the classical one eliminating necessity in special (e.g., single-crystal) substrates for the oriented crystallization. The role of the artificial epitaxy in relation to the classical one in thin film technology is similar to the role of artificial crystals in relation to natural ones in application of crystals as general.

1. N.N. Sheftal and A.N. Bouzynin, Vestnik MGU (Bulletin of Moscow Univ.) Ser. geol., No.3, pp. 102-104.
2. N.N. Sheftal, in: Growth of Crystals, vol.10, ed. N.N. Sheftal (Consultants Bureau - Plenum Press, N.Y. 1976), pp. 185-210.

07.2–3 GRAIN SIZE, TEXTURE AND DOPING PROFILES OF POLYCRYSTALLINE SILICON INTERFACES.

By H.Eichermüller, Siemens AG, UB Bauelemente, D-8000 München; L.Treitinger, Siemens Forschungslaboratorien, D-8000 München; H.v.Philipsborn, Universität, D-8400 Regensburg.

On (100)-oriented Si substrates, half-covered with SiO_2, polycrystalline Si layers of 80-400 nm thickness were prepared by low pressure chemical vapour deposition at 625°C and B- and As-doped by ion implantation.

Grain size and texture were analyzed by X-ray diffraction. The average size of columnar grains is larger in doped than in undoped layers, due to improved recrystallization of layers previously amorphized by ion implantation doping. All samples are strongly textured.

Electrical measurements yield supporting evidence. The saturation concentration for B and As in poly-Si is about 1.3 times larger than for mono-Si. A correlation between grain size and specific resistance was found, indicating that deposition of amorphous Si and subsequent annealing results in layers of lower resistance than direct deposition of polycrystalline layers. Doping profiles were determined by spreading resistance measurements and are correlated to crystallographic properties.

A better understanding of physical effects in bipolar transistors was gained by these crystallographic studies.