The Structure of Thin Films of ZnS and Cryolite

S.Lugomer, M.Crnadak and M.Stipančić
Electrotechnical faculty B.Luka

The structure of ZnS and cryolite thin films by means of electron microscopy studies have been investigated.

Multilayer optical thin films have been obtained by deposition process in vacuum of 5.10^{-6} mmHg in evaporator "VARIAN NRC 836" by using an electron gun of power of 6kW (6kV,1A). Deposition process on NaCl substrates by means of an automatic system "ADS 200" have been controled.

Samples of the optical thin films were thermaly treated during one hour on temperatures between 100 and 200°C. Micrographies and difraction patterns of the samples under the room temperature conditions, and those one hour treated on 100,150 and 200°C can be seen on Figs.1,2,3 and 4.

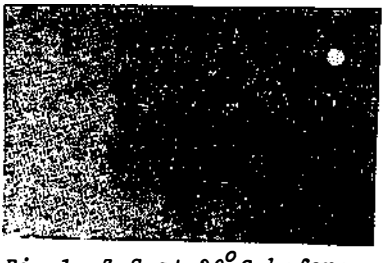

Fig.1. ZnS at 20°C before heat treatment

Fig.2. ZnS after heat treatment at 100°C for 1 hour

Fig.3. ZnS after heat treatment at 150°C for 1 hour

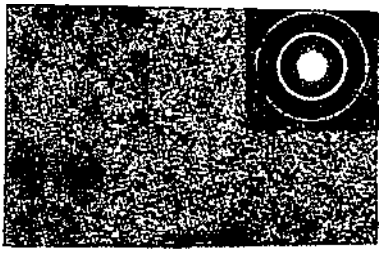

Fig.4. ZnS after heat treatment at 200°C for 1 hour

From those studies of ZnS one concludes that some structural changes, like granulation, are induced by thermal treatment, but the structure of multilayers persist in cubic (sphalerite) from, and does not contain hexagonal modification.

Diffusion type difraction pattern of all the samples are in agreement with average crystal size (100 Å for the samples not thermaly treated), which can be seen from micrographies. The main effect of thermal treatment seems to be the increasing of some crystal grains. It seems, however, that higher temperatures are needed to achieve more intensive recrystalisation. Some trials in that direction have been performed by increasing the beam intensity in electron microscope. The result were grains of diametar > 500 Å, showing very sharp diffraction patterns (Fig.5.).

The structure of cryolite thin films obtained under the same conditions like ZnS, could not been observed directly on the electron microscope. However, the structure of cryolite have been reconstructed indirectly from double-layer cryolite + ZnS. Namely, the cryolite layer have been soluted in water, and in relatively fine structure of ZnS stayed the inprint of cryolite structure. It can be concluded that cryolite layer is of discontinued structure containing the polyedar type of grains (Fig.6.).

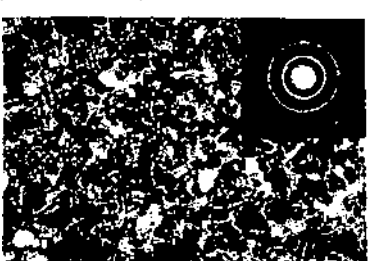

Fig.5. ZnS after recrystalisation in electron microscope

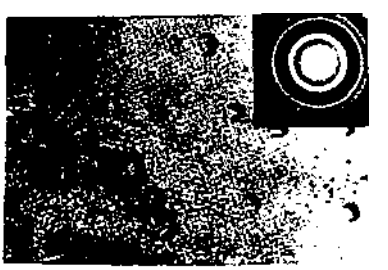

Fig.6. Micrograph of cryolite thin film - replica

Following the conclusion of these preliminary studies, one can say that the structure of those films in given temperature interval is thermaly stable.