11.3–3 DETERMINATION OF THE DIFFUSION TENSOR IN MONOCRYSTALLINE NAPHTHALENE AT 343 K.

A.Dautant, L.Bonpunt, B.Fakhari, N.B.Chanh, Y.Haget

Laboratoire de Cristallographie, associé au C.N.R.S. LA.144 - Université de Bordeaux I - 33405 - Talence-Cedex France.

For a general study about the nature and mobility of point defects in organic molecular crystals, tracer diffusion of β-Naphtol $8^{14}C$ into naphthalene single crystals at 343 K was investigated. Diffusion coefficients have been measured in four different crystallographic directions for a complete determination of the diffusion tensor.

The orientation and subsequent cutting of crystals are obtained from optical observations with polarizing microscope followed by Laue diffraction experiments. The selected face is polished by the microtome technique. The so prepared crystal is pre-annealed at 350 K. The β-naphtol $8^{14}C$ tracer is then deposited by contact with a glass plate on which methanolic solution of tracer has been previously evaporated. After thermal treatment at 343 K the crystal is cut off into slices of 4 μm thickness parallel to the face coated with the tracer. Each slice is analysed both by UV absorption for determining the total quantity of matter and by radioactive counting.

When the diffusion profile shows a contribution of extended defects to the observed mobility, the corresponding activity is withdrawn as proposed by Leclaire and Rabinovich (J.Phys.Solid State Phys. 14,(1981),3863). From the so corrected diffusion profile, we deduce the tracer diffusion coefficient D, characteristic of the bulk diffusion perpendicular to the crystallographic plane selected for the deposition of the tracer. According to the selected direction, the measured diffusion coefficients vary from 4 to 15 10^{-17} $m^2.s^{-1}$.

The characteristic features of the diffusion tensor, principal axes and their relative lengths, are compared with the different possible jumps for one molecule from its site to a neighbouring vacant site.

11.3–4 RUTHERFORD BACKSCATTERING AND X-RAY DIFFRACTION STUDIES OF NUCLEAR TRACKS IN GARNETS

By A. Timm, Fachbereich Physik der Philipps-Universität, D-3550 Marburg and B. Strocka, Philips GmbH Forschungslaboratorium Hamburg, D-2000 Hamburg, FRG.

$(Y,La)_3(Fe,Ga)_5O_{12}$ epitaxial garnet films on $(\bar{1}\bar{1}1)$ $Gd_3Ga_5O_{12}$ substrates irradiated with ^{238}U ions of 1.4 MeV/u specific energy in the dose range 10^{10} cm^{-2} to $3\cdot10^{11}$ cm^{-2} were measured before and after annealing applying Rutherford backscattering and double-crystal X-ray diffraction. The yield of backscattered $^4He^+$ ions was determined using the particle channeling technique (Channeling, ed.: D.V. Morgan, Wiley, New York, 1973).
Each ion impact produces a nuclear track of about 10 μm length and about 10 nm diameter (M.P.A. Viegers, Electron Microscopy 1982, Vol. 2, p. 187). Macroscopically, the irradiation leads to a lattice expansion normal to the sample surface (B. Strocka, G. Bartels and R. Spohr, Appl. Phys. (1980) 21, 141) and to a variation of the magnetic properties (P. Hansen and H. Heitmann, Phys. Rev. Lett. (1979) 43, 1444) of the garnet film.
The increase of the yield of the backscattered $^4He^+$ ions with the ion dose corresponds to the dose-dependence of the induced lattice strain. The above mentioned track diameter of 10 nm was also obtained from these measurements. The recrystallization due to annealing of the formerly amorphous track volume is confirmed by the backscattering spectra of ions channeled in [111] direction comparing irradiated and unirradiated sample areas. So far the healing of the irradiated garnet films has been deduced from X-ray diffraction measurements (B. Strocka, P. Hansen and H. Heitmann, Radiation Effects (1983) 72, 219).

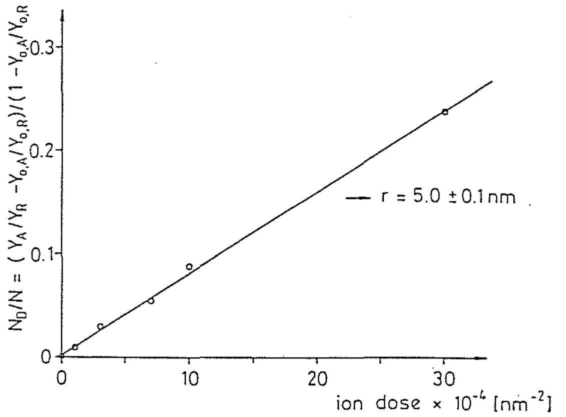

Fig.: normalized number of displaced atoms due to radiation damage vs. ion dose

Y_A, Y_R =: backscattering yields at "zero" depth in [111], random direction

$Y_{o,..}$ =: backscattering yields of unirradiated sample