pressures ranging from 1 to 41 atm, in mixture with: N_2, O_2, CO, CO_2, NO, N_2O. The general trends are: a) the spectral distribution corresponds to vibrational bands of the molecular of the impurity, b) the amplitude of the light pulse is nearly independent from the impurity pressure until quenching values are reached, c) the amplitude is independent from the He pressure except for N_2 and CO mixtures, for which inversely proportional to this pressure, d) the decay time depends only from the partial pressure of the impurity, and is inversely proportional to this pressure (times of the order of 15 μsec at 10^{-3} Torr). At low concentrations the decay time due to impurity may be much longer of that of u.v. emission. This fact means that the energy source for impurity excitation is different from that of u.v. radiation. Are so excluded Pennig effects on impurity molecules produced by He atoms in metastable states. Taking also into account that the energy expended in ionization goes mainly in He_2^+ states, the most probable mechanism is the charge exchange: $He_2^+ + M \rightarrow 2He + M^{+v} \rightarrow 2He + M^+ + h\nu$; where M^{+v} is the molecular ion of the impurity in a vibrational excited state. This mechanism was suggested by Bennet [3] for He-N_2 mixture at 350 Torr. The maximum energy available for transfer in He_2^+, in its higher excited states is about 20.5 eV. A degree of vibrational excitation of He_2^+ ions, depending on the pressure, might show up through a variation of the yield of the impurity ions, when the energy required to produce the appropriate state is near to 20 eV. This is the case of the $B^2\Sigma^+$ states in N_2^+ and CO^+ (18.8 and 19.7 eV respectively). The cross sections for the charge exchange deduced from the time dependence (point d), are of the order of 10^{-14} cm^2. The experimental data on helium mixtures will be given in a more detailed paper.

References

1. R. J. Esterling and N. H. Lipman, Rev. Sci. Instr. 36 (1965) 493.
2. T. Takahashi, S. Kubota and T. Doke, Phys. Letters 23 (1966) 321.
3. W. R. Bennet, Ann. of Phys. 18 (1962) 367.
4. P. Guazzoni and M. Pignanelli, Nuovo Cimento 40 (1965) 454.
5. A. V. Phelps, Phys. Rev. 99 (1955) 1307 and Phys. Rev. 117 (1960) 619.

* * * * *

PHONON DISPERSION MEASUREMENTS ON AN ARGON SINGLE CRYSTAL AT 4.2°K

H. EGGER, M. GSÄNGER and E. LÜSCHER
Physik-Department der Technischen Hochschule München, Germany

and

B. DORNER
Kernforschungsanlage Jülich, Institut für Festkörper- und Neutronenphysik, Germany

Received 18 November 1968

Phonon dispersion measurements by inelastic neutron scattering on an argon single crystal at helium temperature have been performed.

A single crystal of Ar of about 45 cm^3 volume with fcc structure has been grown from Ar with natural isotopic mixture (σ_{coh} = 0.40 barn, = 0.25 barn) and an impurity concentration ppm. The growing technique, including handling and testing of the crystal, has already been described [1]. The specimen was mounted in a cryostat such that it was completely surrounded by aluminium walls and could be cooled to liquid helium temperature.

The neutron measurements were performed with the triple axis spectrometer at the FRJ-2 reaction in Jülich. The cryostat was mounted on a special goniometer for orientation of the sample