X-Rays Emitted by Implanted Argon Atoms

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INTRODUCTION

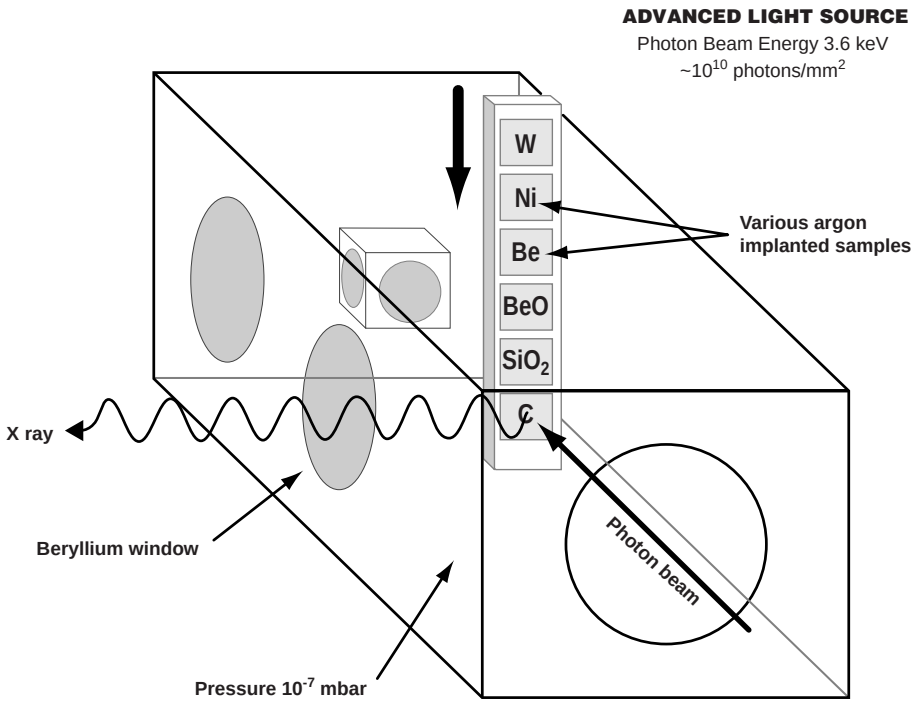
Experiments have been performed on argon atoms in a gas and implanted in solids to determine whether the crystal structure modifies the energy levels of the implanted argon atoms.

EXPERIMENTS

Argon atoms were implanted in various solid targets (metals, semiconductors, and insulators) at depths of the order of 1000 angstroms and ionized in the K shell with photons at an energy slightly greater than the Ar K-shell binding energy. Typical samples studied were metals such as W, Be, C, and Ni, and insulators, such as BeO and SiO_2. Concentration of the implantation was in the range 10^{15} to 10^{16} cm^{-2}.

This experiment was conducted on beamline 9.3.1 at the Advanced Light Source in Berkeley; this beamline uses a double-crystal monochromator to cover an energy range from 2 to 6 keV. Typical photon flux is of the order of 10^{10} photons/mm^2.

The fluorescence from the implanted Ar atoms following K-shell ionization was detected with a very high-resolution Si(Li) detector. These fluorescence spectra have been compared with those emitted by Ar atoms in a gas cell following excitation. The $K\alpha$ lines of implanted Ar atoms were found to be shifted downward in energy by about 2 eV for most targets relative to Ar gas atoms, while the relative intensity of the $K\beta$ and $K\alpha$ lines is similar in gas and solid targets.



PLANS

Plans for upcoming beamtime are to do similar measurements with much higher spectral resolution of the fluorescence radiation by replacing the Si(Li) detector with a crystal spectrometer.

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