Laboratori Nazionali di Frascati

LNF-87/49

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Estratto da:
SIF - Conf. Proc. "Synchrotron Radiation at Frascati" Vol. 5, 127 (1986)

Servizio Documentazione
dei Laboratori Nazionali di Frascati
P.O. Box, 13 - 00044 Frascati (Italy)

X-RAY ABSORPTION SPECTRA OF Xe IN Xe^+ IMPLANTED SILICON

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The non miscibility of rare gases in metals and semiconductors results in the formation of bubbles in rare gases implanted materials. This happens only sometimes in as implanted samples, but often in annealed ones.

Bubble existence, pressure and aggregation states have been investigated by transmission electron microscopy, X-ray scattering and electron energy loss spectroscopy in the case of Ne, Ar and Kr. On the other hand the behaviour of implanted Xe^+ ions has never been studied.

We present the X-ray absorption spectra, recorded at the Frascati synchrotron radiation facility PULS, on the L_3 absorption edge of Xe in Xe^+ implanted silicon, by using fluorescence detection.

Samples have been prepared by implanting Xe^+ ions at 100 KeV on Si with a total dose of $2x10^{16}$ atoms/cm^2 and $1x10^{17}$ atoms/cm^2. The penetration depth is of about 800 Å at this energy. Measurements have been performed on as implanted materials and on the same samples once annealed for 30 min and 60 min at 600°C and at 750°C.

EXAFS data analysis didn't show any EXAFS signal in the as implanted material, thus revealing the presence of atomic Xe loosely bounded to the matrix, whose only contribution is an extra-atomic relaxation which results in the disappearance of the multielectron transitions clearly observable in the Xe absorption spectra.

Such matrix effect has been observed also on the K-edge of Ar in Ar^+ implanted Si and in glow-discharge a-Si:H prepared in Ar atmosphere. In the range of annealing temperatures and times considered two situations have been encountered: a Xe K-edge spectrum identical to the as implanted sample or a too low Xe concentration after the annealing process. At this time we cannot distinguish between two possibilities: if there is or not the formation of bubbles in the case of Xe and if the temperature range in which the bubbles exist, before Xe releasing, is very small.