

Structural environment of krypton dissolved in vitreous silica

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ABSTRACT

X-ray absorption measurements on Kr dissolved homogeneously in vitreous silica (1.97 wt% Kr) have been carried out at the Kr K-edge at 4.5 K, representing the first direct determination of the sites occupied by a noble gas. The presence of EXAFS oscillations shows that the Kr atoms are surrounded by a well-defined shell of nearest neighbors, identified as oxygen atoms. The mean Kr-O distances are $3.45 \pm 0.1 \text{ \AA}$, based on a simple model of Gaussian disorder, with a Debye-Waller factor of $\sigma^2 = 0.06 \text{ \AA}^2$. The large Kr-O distance, which is at the upper limit of the size of the holes existing in vitreous silica, together with the existence of well-defined sites suggests a forced, densely packed environment of oxygen around Kr atoms characteristic of clathrasil surroundings.