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Agglomeration of Point Defects in Copper after Neutron Irradiation at 4·6 K

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Copper single crystals were neutron irradiated at 4·6 K in the Forschungsreaktor München with a dose of about 4×10^{18} cm^{-2}. The diffuse scattering of Cu $K\alpha_1$ X-rays was measured at 8 K around the 400 and 220 reciprocal-lattice points. In an annealing program the measurement was repeated at several steps up to 1000 K. On the same specimen the lattice parameter change $\Delta a/a$ and, with a Cu wire mounted in the specimen holder, the electrical resistivity changes were determined. The symmetry and the absolute intensity of Huang scattering together with $\Delta a/a$ show that immediately after irradiation there are interstitial clusters. The interstitials are arranged spatially in clouds rather than in loops. Assuming linear superposition of the distortion fields, one calculates an average number of about 28 interstitials per cluster. The transition of Huang scattering to asymptotic scattering yields an estimated average cluster diameter of 30 Å. During annealing the Huang intensity increases with temperature. This suggests an increase of the interstitial cluster size containing on the average a maximum number of about 200 interstitials at room temperature. In stage I (30 to 68 K) the symmetry of the Huang intensity distribution changes, indicating a change of the cluster form from the spatial arrangement of the interstitials to dislocation loops. Above 150 K there is a faster decrease of $\Delta a/a$ than of the asymptotic scattering and the asymmetry of the Huang scattering is reduced. This can be attributed to the clustering of vacancies which then contribute noticeably to the diffuse scattering. At 1000 K the defects have been completely annealed.

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X-ray Scattering from Graphite Crystals containing Interstitial Basal-Plane Loops*

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The diffraction effects arising from the presence of interstitial loops in a graphite crystal are analyzed using a high-speed computer. The loops are assumed to be circular clusters of atoms in the *C* position of the normal *ABAB*... sequence of graphite planes. The resulting defect is a finite extrinsic fault and its associated strain field. The diffuse scattering around relpoints for which $H-K=3N$ depends on the symmetry of the loop strain field and is concentrated around the relpoint. The diffuse scattering around relpoints for which $H-K\neq3N$ reflects the disruption of the stacking sequence and is characterized by streaks connecting the relpoints. A similar analysis for an isotropic medium was in excellent agreement with experimental results on neutron-irradiated BeO [Keating, D. T. & Goland, A. N. (1971). *Phys. Rev.* B**4**, 1816–1832]. However, X-ray data taken on neutron-irradiated graphite single crystals do not agree with the calculations, in that streaks are observed connecting all relpoints [Eeles, W. T. (1968). *Acta Cryst.* A**24**, 688–689, and private communication]. A possible explanation for the disagreement is that the large stress at the loop boundary causes a crack to develop. If so, the defect is no longer a simple loop and a different displacement field must be used in such calculations.

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