W0441

Effects of Absorbed Dose on X-ray Radiation Damage in Protein Crystals at Cryogenic Temperatures.
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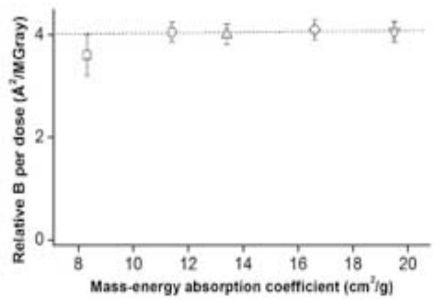
X-ray radiation damage to biological crystal is known to depend on parameters of the experimental setup (e.g. beam size, shape and energy, oscillation mode, etc.) as well as on the crystal itself (e.g. its size and shape, composition, etc.). We have measured how radiation damage at cryogenic temperatures depends on the crystal constituents and structure of four proteins: lysozyme, catalase, thaumatin, and apoferritin. We characterize radiation damage as degradation of relative B-factors per absorbed dose and define a coefficient of sensitivity to absorbed dose $S_{AD} = \frac{\Delta\langle u^2\rangle}{\Delta D} = \frac{\Delta B_{rel}}{8\pi^2 \Delta D}$ that serves as a robust measure of damage. Our results show that at cryogenic temperatures, the relative B factor per incident photon fluence increases linearly with the mass-energy absorption coefficient. The change in relative B-factor per dose, however, stays roughly independent of the mass-energy absorption coefficient (given by the crystal composition) and is about the same for all crystals, with S_{AD} ~ 0.014 Å^2/MGy. These results suggest that cryogenic radiation sensitivities per absorbed dose are unlikely to show significant protein-to-protein variations, and that radiation damage may in some cases be reduced by using salts with lower atomic number constituents.



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