Using Accurate D-Spacing Measurements to Check for Temperature Changes and Effects of Radiation Damage

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If the expansion coefficient of a crystal for a given direction in reciprocal space is known the accurate measurement of the Bragg angle provides very accurate means for the measurement of temperature changes. Experiments carried out at an unfocussed undulator beamline using organic small molecule compounds revealed no increase in temperature if the flux density was changed from low to the maximum value. However, the d-spacing was linearly and irreversibly increasing with radiation dose. Due to its linear nature and since its effect on the d-spacing is rather small, an exposure of 10 min causes the same d-spacing change as a one degree temperature rise, a significant change in temperature with a change in flux could be ruled out.

The change in d-spacing according to the radiation dose was used to investigate the temperature and the energy dependence of the rate controlling radiation decay process. A rather low activation energy of only 0.009eV was found for the temperature dependence. In case of the investigated pure light atom compounds there seems to be little advantage to go for wavelengths lower than 0.8A.