

**Sample Preparation for Femtosecond Electron Diffraction:
The Photodissociation of Molecular Iodine in a Solid-state Matrix**

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Abstract

Of the various techniques that can be used to study a molecule, electron diffraction allows us to see the positions of atoms in a molecule. With femtosecond (10^{-15} seconds) electron diffraction, it becomes possible to follow atoms as they move during a chemical reaction.

The photodissociation of iodine is an extremely well-characterized reaction and is an excellent candidate for the first femtosecond diffraction experiment on a molecular system. However, the sample must conform to very strict requirements and this introduces difficulties into the sample preparation stage of the experiments.

An iodine-containing copper polymer is proposed for these experiments. The copper polymer provides a matrix in which the iodine photodissociation occurs. This allows us to view the reaction dynamics of iodine, as well as the effect of a matrix “cage” on those dynamics. The goal of the sample preparation was to produce thin, large-area films suitable for femtosecond electron diffraction experiments to produce the first femtosecond “movie” of a chemical reaction.