

~~Special Polymer Physics Seminar ~~

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Quantum Amplified Isomerization: A photoinitiated chain reaction in glassy polymers

Efficient chemical reactions in truly solid media are rare; *chain reactions* in solid media would seem impossible because of the lack of diffusion of chemical species. Through collaborative research with colleagues at the University of Rochester, we developed just such a chain reaction that we call "Quantum Amplified Isomerization" (QAI). QAI is a remarkable photoreaction that proceeds with *chemical amplification* (i.e., more than one product molecule formed per photon absorbed), even in glassy polymer media. Specifically, polymers containing strained-ring moieties underwent spontaneous photoinitiated isomerization, producing more stable isomers, in the presence of catalytic amounts of appropriate sensitizers. Two different QAI reaction mechanisms were studied, one proceeding by propagation of cation radicals ("holes") and the second by propagation of triplet excited species. The latter mechanism was found to be much more efficient than the former. Certain QAI reactants and products have significantly different refractive indices, and there is only a small change in molecular volume upon isomerization. Therefore, a very sensitive, high-resolution, imaging medium based on modulation of refractive index could be prepared. For example, many overlapping diffraction gratings were recorded in the QAI material. Such refractive index imaging schemes may find applications in holography and for integrated optical devices.

