

Synthesis and third-order nonlinear optical properties of pyridinium diacetylene derivatives

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We synthesized pyridinium diacetylene derivatives and found a variety of properties from the compounds as a result. First, we found the new polymerization reaction that one of the pyridinium diacetylene derivatives (1) aggregate in dipolar aprotic solvent such as DMF and spontaneously convert in to the 1,4-addition type of polydiacetylene while the conventional polymerization of diacetylene monomer occurs only in restricted crystal packing. The third order nonlinear susceptibility of this polymer increased 100 times larger than that of monomer, and this enhancement due to the resonant enhancement originate from the increasing of absorbance by polymerization.

On the other hand, the styrylpyridinium derivatives was not recognized the aggregation and polymerization that mentioned above, and exhibit remarkable high two-photon absorption cross section ($\sigma^{(2)}$) measured by the open aperture Z-scan method with femtosecond pulse. From the measurements, we found that introduction of triple bond as a central π -bridge is efficient to enhance $\sigma^{(2)}$ without a large red shift of the peak wavelength of $\sigma^{(2)}$ spectra. Furthermore, we found that these compounds increasing $\sigma^{(2)}$ as approaching measurement wavelength to one-photon absorption band. This phenomenon is another candidate for design strategy for sensitive two-photon absorption materials because the enhancement overcome the general near infrared peak of $\sigma^{(2)}$ spectra by a place.

