STABILITY OF NANOPOLYACETYLENE AT LASER EXCITATION OF RESONANT AND NON-RESONANT RAMAN SCATTERING

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We present resonant and non-resonant Raman scattering experiments for free-standing nanopolyacetylene (NPA) films in which long-duration irradiation by high intensity laser beams does not lead to film destruction. NPA films with thickness from 0,005 to 1 mm consist of 0.5-2 percents polyacetylene nanoparticles by weight having diameter from 15 to 30 nm dispersed in a matrix of poly (vinyl butyral). The calculated energy absorbed from the laser irradiation exceeds that required for thermal destruction of NPA films by a factor of 10-1000. These results allow one to suppose that laser irradiation leads to excitation of coherent vibrations in trans-NPA. Coherent vibrations are characterized by non-Boltzmann energy distributions, and increased absorption of the laser energy from Raman scattering of trans-NPA leads to an increase in the amplitudes, but not frequencies, of the coherent vibrations. Thus NPA can absorb much more coherent light than non-coherent light. Growth of coherent light absorption is accompanied by only very weak heating of NPA films. Questions remain regarding the energy balance for the irradiation experiments, but one possibility is that NPA films undergo an energy exchange between nanoparticles, which are irradiated with those that are not irradiated.