LASER INDUCED EMISSION SPECTROSCOPY OF CARBON CLUSTERS IN SOLID ARGON

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Carbon-vapor molecules (C_1 - C_3) produced by evaporation of graphite in vacuum were embedded in argon matrices where larger clusters were built in chemical reactions induced by controlled annealing. For identification of the produced molecules, high-resolution FT absorption spectroscopy in the uv-visible and infrared spectral ranges was used. The clusters embedded in the matrices were selectively excited by a pulsed dye laser system and time-resolved dispersed fluorescence and phosphorescence spectra were obtained by a gated photodiode array spectrometer. The very high sensitivity of our setup allowed us to detect extremely weak emission peaks of molecules that could not be studied by the emission spectroscopy till now.
We analyzed the excitation and emission spectra of linear C_3, determined the lifetimes of the $A^1\Pi_u$ and $a^3\Pi_u$ excited states of C_3 in solid argon and showed a fast vibrational relaxation in the excited states. For the first time, we could measure the weak fluorescence spectra of carbon clusters larger than C_3. We studied the fluorescence emission and excitation spectra of linear C_6 and determined the frequencies of the symmetrical stretchings of C_6 in its ground state $X^3\Sigma_g^-$. At present, we are analyzing emission spectra of other carbon clusters.