Local Heating and Dissociation of Organic Molecules by IR Fields

H. Jungclas, L. Schmidt, V. V. Komarov[a], A. M. Popova[a], and I. O. Stureiko[a]

Chemistry Department, Philipps-University Marburg, 35032 Marburg, Germany
[a] Institute of Nuclear Physics, Moscow State University, Moscow 119899, Russia

Reprint requests to Prof. Dr. H. J.; Fax.: +49-6421-28 62830, E-mail: jungclas@staff.uni-marburg.de

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A nonstatistical model for internal transition of collective vibrational energy to specific bonds in organic molecules is presented. The model is developed for molecules which contain a chain of identical biatomic dipoles, e.g. C–H groups. Resonant IR fields can induce collective vibrational excitations (excimols) in the dipole chain. The accumulated vibrational energy can be transmitted to particular bonds, which are not part of the chain but close enough for dipole-dipole interactions. Specific properties of such bonds enable a pile up of harvested excimol energy there, thus making dissociation of these bonds a likely exit channel. An analytical expression for the calculation of dissociation probabilities was derived and analysed. It is shown that the dissociation probability strongly depends on the position and orientation of the bond relative to the position and orientation of the dipoles in the chain. The consequences of the presented model were experimentally checked by comparing the fragmentation of the isomers Leucine and Isoleucine. — PACS: 30.00 - 34.10 - 36.40

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