

Light –induced dispersed vibrational IR-emission: a new technique to study molecular states

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Infrared Emission Spectroscopy, technique rarely applied in the past. Most of previous studies were carried out on gases or condensed phases by heating the specimen to a high temperature by means of electrical heating element. By using of FT-IR technique we developed a new approach of light-induced infrared emission spectroscopy, which is a method based on generation of infrared radiation in the absence of sample heating. The emission spectra were recorded during steady state illumination with visible light with a power of 10- 450 mW/cm². The IR-radiation usually was trapped from a front surface of the sample. Some interesting features of this method are:

1. The technology used make experimentally feasible to excite the infrared emission in practically all solid or liquid samples without their destruction. IR-emission signal had shown to have the capacities for a component and conformer selectivity.
2. This approach allowed us to obtain simultaneously IR-active as well as Raman-active modes, therefore spectra measured contain more rich information about the composition of the eigenstates in comparison with the basic vibrational spectroscopy [1]. Although the theoretical description is absent in the literature, the mechanism underlying the non-thermal IR emission spectroscopy can be understood on the basis of the principles formulated previously for active Raman spectroscopy because the physical processes similar to those underlying stimulated Raman scattering [2].
3. Resonance-enhanced infrared signal depends on the both internal molecular properties of the sample and a specific signature of the electromagnetic fields.

There is promise that this nonlinear IR method will have important application in determining the structure and dynamics molecules. We plan to discuss it in our presentation.

- [1] *Gagarinov A.G., Degtyareva O.V., Khodonov A.A., Terpugov E.L.*, Stimulated infrared emission in all-trans retinal and wild-type bacteriorhodopsin under CW optical pumping: studies by FT-IR spectroscopy // *Vibrational Spectr.* **42**, (2006). Pp.231-238.
- [2] *Akhmanov A. and Koroteev N.I.*, Methods of Nonlinear Optics and Light Scattering Spectroscopy // Moscow, Nauka, (1981). 586 pages.