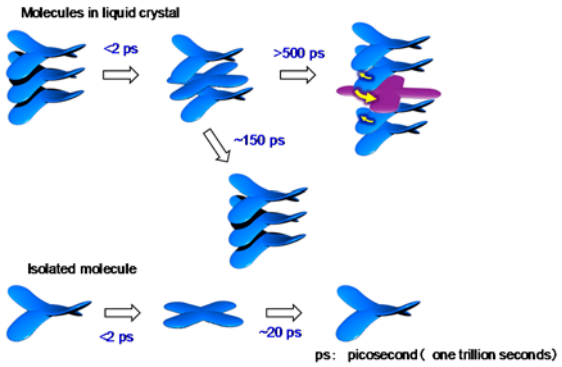
Research Highlights

Movie of molecules in liquid-crystal – molecular motions in one trillionth seconds

The motion of molecules in liquid crystal phases has been used for wide ranging industrial applications, such as displays for televisions and computers. Therefore, there is demand for the development of methodology to identify the key motions of molecules in liquid crystals for their functions.

However, no such methodology exists to directly observe the dynamics of molecules in liquid crystals.



Observed molecular motions.

Here, Masaki Hada and colleagues at Okayama University, Kyoto University, Kyushu University, Tsukuba University, Tokyo Institute of Technology, Nagoya University, Kiel University, the University of Toronto, and Max Planck Institute describe the development of methodology to directly capture the motions of π-extended cyclooctatetraene molecules in liquid crystals.

The methodology consisted of a combination of two different measurements: (1)time-resolved electron diffraction to observe the molecular periodicity changes with atomic spatial resolution and temporal resolution of one trillionth seconds; and (2) time-resolved mid-infrared vibrational spectroscopy to observe the conformational change of an isolated molecule with the relevant temporal resolution.

The chain-motions of π-extended cyclooctatetraene molecules in liquid crystals was revealed, that is, conformational change from saddle to flat structure and subsequent rotational motion induced by steric effect.

This methodology could be also be applied for the observation of molecular dynamics in the photoresponsive functional soft materials containing azobenzene as well as the structural monitoring of photoactive sites in biological systems such as membrane proteins operating in optogenetics and photopharmacology.

Reference:

Authors

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