Terahertz Spectroscopy of Photoconducting Liquid Crystals

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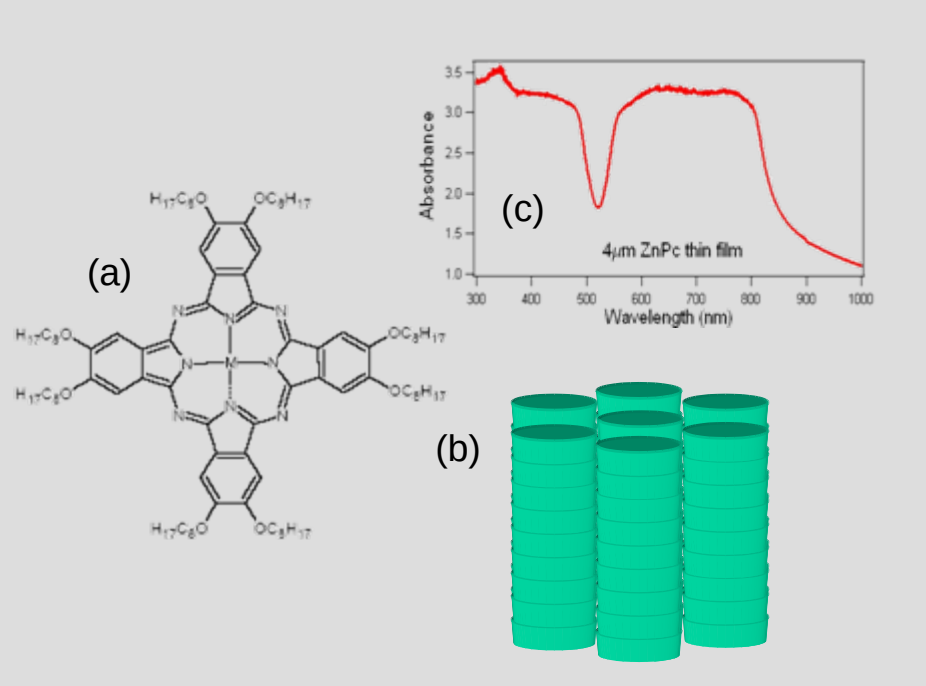

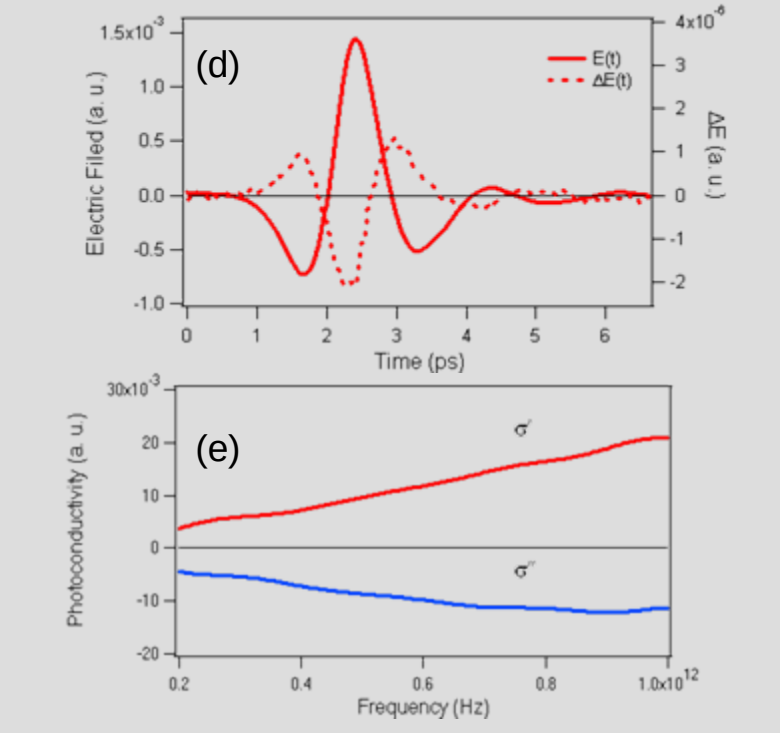

Liquid Crystals (LC) are a relatively new class of photoconductors.

Surprisingly high carrier mobilities approaching that of the amorphous silicon have been lately reported in LCs. Although the high molecular order in these materials has been recognized to play an essential role, the mechanism of charge transport are still not well understood.

As a model LC system, we investigated phthalocyanine (PC) derivatives (a) belonging to a family of discotic LCs. These disk-like molecules self-assemble into columns (b), creating quasi-one-dimensional channels for efficient charge transport. The absorbance of a thin film is shown in (c). Upon photoexcitation at 800 nm, an electrical pulse transmitted through the film at room temperature (solid line in (d)) is modified and the amount is illustrated as the dashed line in (d). This measurement was performed using terahertz spectroscopy based on an ultrafast amplifier. The complex spectral dependence of the photoconductivity (e) was thus extracted through Fourier transforms of the waveforms of (d). These preliminary results showed that significant conductivity was indeed observed in photoexcited PC immediately after photoexcitation and the conductivity increases with frequency up to 1 THz. Further investigation of the nature of such a dependence is underway.