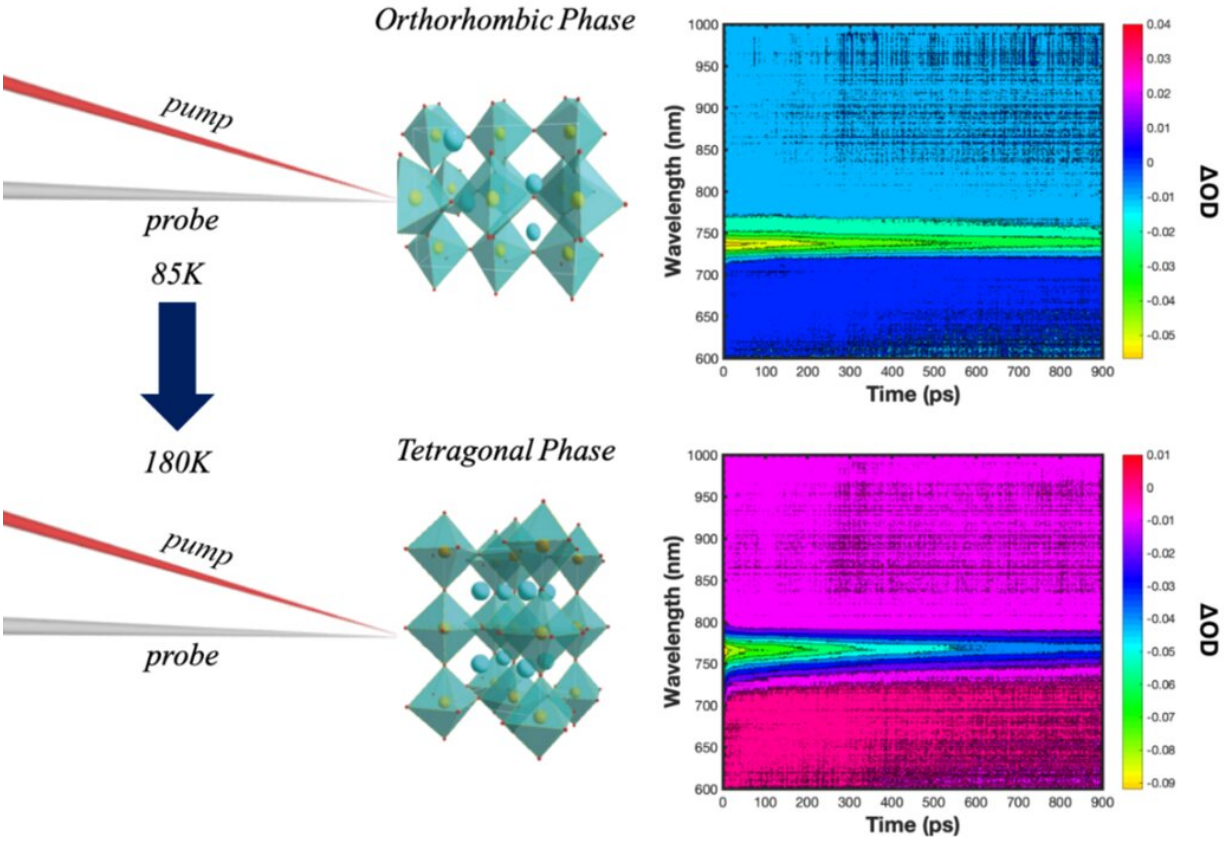
Probing the crucial charge carrier transfer processes and dynamics within perovskite active layers

June 2 2022



Credit: Compuscript Ltd

A new publication from *Opto-Electronic Science* reviews the crucial

charge carrier transfer processes and dynamics within perovskite active layers by means of time-resolved ultrafast laser spectroscopy.

This article provides an overview of how the charge carrier dynamics vary with respect to the crystalline phase of the organic-inorganic perovskite. Despite the fact that organic-inorganic lead halide perovskites have attracted enormous scientific attention for energy conversion applications over the recent years, the influence of temperature and the type of the employed hole transport layer (HTL) on the charge carrier dynamics and recombination processes in perovskite photovoltaic devices is still largely unexplored. In particular, significant knowledge is missing on how these crucial parameters for radiative and non-radiative recombination—as well as for efficient charge extraction—vary among different perovskite crystalline phases that are induced by temperature variation.

The present article presents micro photoluminescence (μPL) and ultrafast time resolved transient absorption spectroscopy (TAS) results in a reference Glass/Perovskite architecture and two different Glass/ITO/HTL/Perovskite configurations at temperatures below room temperature. The objective of this work is to probe and shed light on the charge carrier dynamics of different perovskite crystalline phases, while considering also the effect of the employed hole transport layer (HTL) polymer. Namely, $CH_3NH_3PbI_3$ films were deposited on Glass, PEDOT:PSS and PTAA polymers, and the developed Glass/$CH_3NH_3PbI_3$ and Glass/ITO/HTL/$CH_3NH_3PbI_3$ architectures were studied from 85 up to 215 K in order to explore the charge extraction dynamics of the $CH_3NH_3PbI_3$ orthorhombic and tetragonal crystalline phases. Interestingly enough, the article reports evidence that the charge carrier dynamics at low temperatures are not only affected by the employed hole transport layer, but in addition are strongly correlated to the different perovskite crystal phases.

More information: Efthymis Serpetzoglou et al, Charge carrier dynamics in different crystal phases of $CH_3NH_3PbI_3$ perovskite, *Opto-Electronic Science* (2022). DOI: 10.29026/oes.2022.210005

Provided by Compuscript Ltd