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Composite glasses and perovskites for advanced photonic applications

Herein we present some of our latest work on the development of functional composite glasses and perovskite films that exhibit great potential in terms of their potential use in a variety of photonic applications like wavelength conversion devices, electro-optical switches, optical memory storage, and photovoltaics. First, we demonstrate the impressive second-order nonlinear optical characteristics of a series of silver rich phosphate glasses, while employing laser scanning imaging microscopy in order to determine the effects of both composition and temperature on the second harmonic generation (SHG) efficiency [1]. In addition, we show the inscription of erasable periodic structures on the surface of silver metaphosphate (AgPO3) glass upon utilizing femtosecond laser irradiation processing [2]. The remarkable feature of these AgPO3-patterned glasses lies on the fact that upon heating them to moderate temperatures the periodic structures are erased from the surface, i.e. rendering the glass suitable for infinite write/erase, and re-write cycles. At the second part of the talk, we present important findings on the development of advanced perovskite absorber films and perovskite solar cell devices upon employing different types of charge transfer polymer materials [3]. Finally, we present newest results on the fabrication of superior quality perovskite absorber films by means of laser-assisted crystallization techniques [4]. Time-resolved transient absorption spectroscopy (TAS) under ambient conditions is employed for investigating the improved charge carrier transport and recombination processes within the so-formed perovskite films and device configurations. The revealed charge extraction dynamics are correlated with the corresponding morphological characteristics while shedding light on the charge extraction mechanisms towards the design of state-of-the-art perovskite absorber films and devices [3-5].

Recent Publications

1. Konidakis I et al. (2018) Effect of composition and temperature on the second harmonic generation in silver phosphate glasses. Opt. Mater. 75:796-801.
2. Konidakis I et al. (2018) Femtosecond laser fabrication of erasable periodic surface structures on silver phosphate glass. In preparation.
3. Serpetzoglou E et al. (2017) Improved carrier transport in perovskite solar cells probed by femtosecond transient absorption spectroscopy. ACS Appl. Mater. Interfaces 9:43910-43919.
4. Konidakis I et al. (2018) Improved charge carrier dynamics of CH3NH3PbI3 perovskite films synthesized be means of laser-assisted crystallization. In preparation.
5. Chochos CL et al. (2017) The role of chemical structure in indaceno-dithienothiophene-alt-benzothiadiazole copolymers for high performance organic solar cells with improved photo-stability through minimization of burn-in loss. J. Mater. Chem. A 5:25064-25076

Biography

Ioannis Konidakis was born in Crete, Greece, in 1980. He has a B.Sc. Honours degree in Chemistry from the University of Aberdeen in UK (2002). He received his Ph.D. degree in Chemistry from the same University in 2006. The main subject of his Ph.D. research was ion transport in glasses and polymer electrolytes. In his current research appointment under the supervision of Dr. E. Stratakis at IESL, he is involved in projects of laser-assisted synthesis and development of functional plasmonic composite glasses and perovskites for advanced optical and photovoltaic applications. From 2011 to 2017 he was also appointed a part-time Lecturer in the Department of Materials Science and Technology of the University of Crete. In 2014 he received a Fellowship of Excellence for Post-graduate Research in Greece (24 months, 39K €) from the State Scholarships Foundation (IKY). I. Konidakis is co-author of several refereed journal publications and conference proceedings, and the author of a book chapter.

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