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Raman study of the Flash-lamp annealing influence to Cu2ZnSnS4 nanocrystals and PEDOT:PSS composite thin films

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One of the trends for the future of renewable energy is the use of materials that can combine photovoltaic and thermoelectric properties in hybrid solar cells. These materials should also fulfill a number of other requirements. For instance, they should have a bandgap suitable for photovoltaics and constituent elements should be abundant and non-toxic. All these requirements are covered by the materials from the Cu2ZnSnS4 (CZTS) family. Obtaining them by low-temperature „green" colloidal synthesis in the form of nanocrystals (NCs) makes these materials even more perspective for the third generation of photovoltaics. The improvement and tuning of the NCs properties after synthesis and deposition onto a (flexible) substrate are very important tasks. Flash-lamp annealing is gaining popularity due to the short time of treatment, scalability, and no need for special conditions such as atmosphere and pressure. PEDOT:PSS is a very well-known conductive polymer widely used in photovoltaics and thermoelectrics. Here we report the effect of flash-lamp annealing (FLA) with optimised energy density on composite films with different ratios of CZTS NCs and PEDOT:PSS in the solution deposited onto a glass. There are so far no studies about FLA treatment of PEDOT:PSS or the mixed composites. Using Raman spectroscopy as a main characterisation tool it is shown that the influence of FLA treatment on the composite films differs significantly from the influence on the pure materials and that PEDOT:PSS plays a protective role with respect to the CZTS NCs.

Topics

Session A. Physics of condensed matter and spectroscopy

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