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Use carbon nanotubes/carbon composite counter electrodes as hole transport layer for efficient methylammonium lead bromide perovskite solar cells

Xiaohui Liu and **Yanfang Gao**
Inner Mongolia University of Technology, P.R. China

Organic–inorganic metal halide perovskites, especially methylammonium lead halide or mixed halide, have attracted significant attention as promising materials for photovoltaic applications due to their high absorption coefficients, excellent carrier transport, chemical and structural diversity, and proper band gap.[1]Most efficient perovskite solar cell devices employ organic charge transfer materials,such as an organic hole transport material (HTM) of 2,2',7,7'-tetrakis-(N,N-di-p-methoxy phenylamine)-9,9' -bifluorene (spiro-MeOTAD) or an electron transport material of phenyl-C61-butyric acid methyl ester in combination with metal electrodes. The utilization of organic electronic components not only raises devices cost but also affects their long-team stability. Thus, it is highly desirable to develop perovskite photovoltaics which are free of organic materials.[2] Carbon materials, due to their excellent stability, low cost and facile processability, have been used to replace the expensive HTM and noble metal electrode in perovskite solar cells and achieved reliable efficiency and impressive stability. [3]carbon nanotubes being a promising candidate due to their extraordinary electrical and mechanical properties.Here we focused different carbon materials such as commercial graphite,carbon black,commercial hard coal,biochar and active carbon,thus can find a better material for the improvement of the perovskite solar cells. The semi-transparent,high voltage MAPbBr3/CNT solar cells will show great potential in solar cell windows, tandem solar cells and solar fuels applications. Carbon are nanotubesexcellent electronic transporting materials due to their exceptional charge transport feature as well as their chemical stability and hydrophobicity. Carbon nanotubes have become one of the promising components in perovskite solar cells.

yf_gao@imut.edu.cn

Rapid room-temperature synthesis of doped carbon materials via polymer dehalogenation for electrochemical applications

Xiaoming Sun and Guoxin Zhang
Beijing University of Chemical Technology, China

Sustainable developments of human society rely on the efficient utilization of clean energy, which are now urging effective, low-cost key materials to build up new technologies. Among those promising candidates, carbon materials have been long tested to be effective in widely spread fields. However, their synthesis are currently going through a few drawbacks; for instance, the defunctionalization and carbonizations of carbon raw materials often require high-temperature pyrolysis which emits large amount of gases. And, in most cases, those gaseous byproducts are hazardous. We proposed a facile route to synthesize carbon materials under mild conditions (such as room temperature) via. the defunctionalization of halogenated polymers (such as PVDF, PVDC, and PVC) by strong alkaline (such as KOH). XPS characterization revealed over 75.0 at% carbon presenting in resulted carbon. Meanwhile, synthetic routes to heteroatom doped carbon were also established via. the strategy of polymer dehalogenation. No gaseous byproducts were formed, instead, non-hazardous, easy-to-handle alkali metal-halogen salts were obtained. The underneath mechanism was investigated. Halogen functionalities are easy to leave upon mild activation, as written in text books. The dehalogenated carbon sites are highly reactive that could rapidly couple any adjacent atoms, if carbon, forming C-C, if heteroatom, forming C-X (X represents N, S, P, B and so forth). The strategy of dehalogenation can be also extended to "2D" halogenated polymer: graphite fluoride (GF). GF could be also defunctionalized at room temperature using strong alkaline and in situ functionalized with O, if applying KOH, or N, if applying NaNH2, leading the formation of water soluble O- or N-doped graphene, respectively. Above mentioned routes to carbon materials, especially, water soluble graphene are benign, environment-friendly, and easy-to-operate, which hold great potentials for practical applications.

sunxm@mail.buct.edu.cn