Structural investigation of organic-inorganic perovskite based solar cells with carbon cathodes

Avi Schneider, Lioz Etgar

The Institute of Chemistry at the Hebrew University of Jerusalem

Organic-Inorganic Perovskite photovoltaics have gained much scientific attention over the past decade as a potential competitor or complimentary strategy for the currently prevalent and commercialized solar cell technologies. In recent years a number of groups have focused their research on replacing the expensive metal counter electrodes of the cells with carbon based electrodes, with the general goal of lowering production costs. In 2013 Han et. al. reported a novel cell structure based on the use of a screen printed conductive porous carbon film as the counter electrode of the cell, through which the photoactive Perovskite solution is filtrated, reaching and penetrating the functional layers beneath it. Benefits of this structure include a large area of interface between light absorber and counter electrode, increased stability of the cell due to the hydrophobicity of the carbon, and a better compatibility for large scale production, owing to the simple and cheap methods and materials. Other cell structures and methods, implementing Carbon films as their counter electrodes, have been reported by various groups over the past few years, making carbon based PSC's a quite popular approach to overcoming some of the present limitations of this type of cell. Though the various Carbon based PSC's show much promise, they are still lacking in performance when compared with some of the leading Perovskite cell structures. Our main goal in this research is to explore ways to improve the photovoltaic performance of carbon based PSC's, while maintaining the low cost and simple fabrication methods of these cells. Our strategies involve thorough investigation of the nano-scale structure of these cells while intelligently tailoring new methods and materials aimed at maximizing the performance of this specific cell type. A significant improvement could label these cells as the most suitable Perovskite based cells for commercial mass production.