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Long-Term Stability of Photovoltaic Hybrid Perovskites achieved by Graphene Passivation via a Water- and Polymer-Free Graphene Transfer Method[1] W.-S. TSENG, Caltech, M.-H. JAO, NTU, C.-C. HSU, Caltech, C.-I. WU, NTU, N.-C. YEH, Caltech — Organic-inorganic hybrid perovskites such as $CH_3NH_3PbX_3$ (X = I, Br) have been intensively studied in recent years because of their rapidly improving photovoltaic power conversion efficiency. However, severe instability of these materials in ambient environment has been a primary challenge for practical applications. To address this issue, we employ high-quality PECVD-grown graphene to passivate the hybrid perovskites. In contrast to existing processes for transferring graphene from the growth substrates to other surfaces that involve either polymer or water, which are incompatible with photovoltaic applications of these water-sensitive hybrid perovskites, we report here a new water- and polymer-free graphene transferring method. Studies of the Raman, x-ray and ultraviolet photoemission spectroscopy (XPS and UPS) demonstrated excellent quality of monolayer PECVD-grown graphene samples after their transfer onto different substrates with the water- and polymer-free processing method. In particular, graphene was successfully transferred onto the surface of $CH_3NH_3PbI_3$ thin films with sample quality intact. Moreover, XPS and UPS studies indicated that even after 3 months, the fully graphene-covered perovskite films remained spectroscopically invariant, which was in sharp contrast to the drastic changes, after merely one week, in both the XPS and UPS of a control $CH_3NH_3PbI_3$ sample without graphene protection.

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