Scalable Dry Transfer of Graphene for Encapsulating Organic-Inorganic Halide Perovskites

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Perovskites are known for their direct bandgap and cost-effective deposition processes, which positions them as promising candidates for optoelectronic devices [1-3]. However, the susceptibility of organic-inorganic perovskites to moisture and heat poses significant challenges to their commercialization. A highly conductive and hydrophobic single layer of graphene can be combined with perovskite materials to build efficient optoelectronic devices by preventing the diffusion of water and oxygen into the perovskite layer [1]. Graphene also serves as a barrier against ion migration, enhancing the stability and extending the lifespan of perovskite devices [4]. The typical method for transferring large-area graphene onto another material involves the use of water, followed by annealing at temperatures exceeding 100°C [5, 6]. However, this approach is incompatible with halide perovskites. Here, we introduce a novel dry method, which involves the direct stacking of square centimeter-sized graphene layers onto methylammonium lead iodide ($MAPbI_3$) perovskite at low temperature, avoiding liquids. X-ray diffraction (XRD) and photoluminescence (PL) measurements show that the perovskite films endure the transfer process. The main crystalline XRD peaks related to $MAPbI_3$ remain after the transfer, and no secondary phases due to degradation were observed (Figure 1a). Additionally, there was no significant change in the PL peak position and amplitude (Figure 1b and c). Further investigation on the conductivity and defect concentration of graphene after the transfer process will be presented.

References

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Figures

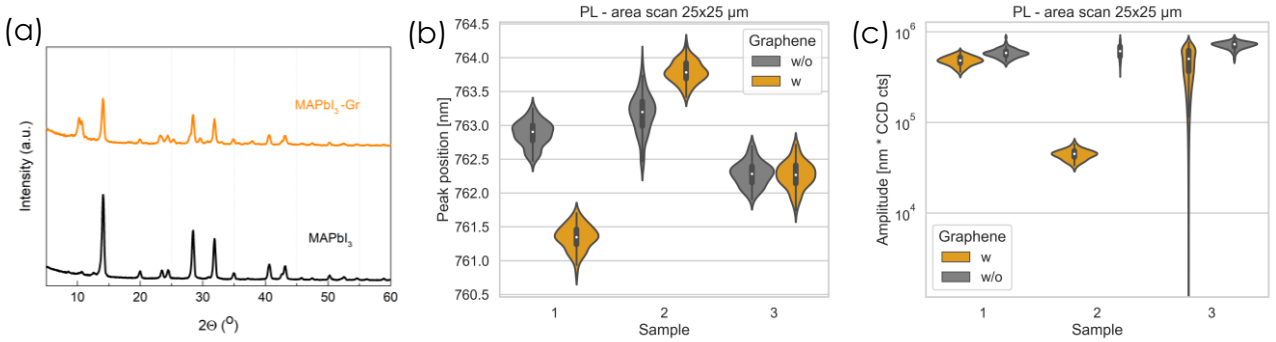

Figure 1: a) XRD of MAPbI3 before and after Gr transfer, b,c) peak position and amplitude of PL of 3 different samples before and after Gr transfer.

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