**High efficiency perovskite materials for solar applications**

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Combining perovskites with well-established photovoltaic materials such as silicon or CIGS is an attractive option for producing cheap, high efficiency and high voltage solar cells. Perovskite-based tandem solar cells can potentially achieve over 30% tandem efficiency, and also have promise for integration into water splitting configurations. We demonstrate a 4-terminal tandem perovskite/silicon configuration in which the efficiency is as high as 26%, with 23.9% for a perovskite/CIGS tandem. We also demonstrate a two-terminal monolithic tandem device with a perovskite top cell and a polysilicon passivated c-Si bottom cell, with an efficiency of over 24%, using a novel approach that avoids the need for a dedicated interconnection layer. We also discuss new approaches to improving the stability of perovskite-based solar cells using 2D passivation layers. These results show the clear potential of perovskites in practical high efficiency devices.