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Application of plasma enhanced atomic layer deposition process of alumina on perovskite film boosts efficiency of solar cells — ●MALGORZATA KOT¹, MAYANK KEDIA², PAUL PLATE³, LUDWIG MARTH³, KARSTEN HENKEL¹, and JAN INGO FLEGE¹ — ¹Applied Physics and Semiconductor Spectroscopy, BTU Cottbus-Senftenberg, Konrad-Zuse-Strasse 1, 03046 Cottbus, Germany — ²Institut fuer Photovoltaik Universitaet Stuttgart, Pfaffenwaldring 47, 70569 Stuttgart, Germany — ³SENTECH Instruments GmbH, Schwarzschildstraße 2, 12489 Berlin, Germany

It is assumed that plasma-enhanced atomic layer deposition (PEALD) cannot be used to prepare thin films on sensitive organic-inorganic perovskites because the plasma destroys the perovskite film and thus deteriorates its photophysical properties. Here, we prove that using an appropriate geometry of the ALD system (SENTECH SI PEALD system) and suitable process parameters it is possible to coat perovskites with alumina by PEALD. Spectromicroscopy followed by electrical characterisation reveal that as long as the PEALD process is not optimized (too long plasma pulses) one gets degradation of the perovskite as well as dissociation of the created iodine pentoxide (during PEALD) under light that causes a valence band maximum (VBM) shift to the Fermi level and thus significantly decreases the solar cell efficiency. However, once the PEALD process parameters are optimized, no VBM shift is observed. Moreover, the solar cell efficiency depends inversely on process temperature and layer thickness.

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