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Supporting Information

On the Effect of Atomic Layer Deposited Al_2O_3 on the Environmental Degradation of Hybrid Perovskite Probed by Positron Annihilation Spectroscopy

Dibyashree Koushik[1†], Frideriki Naziris[2†], Jimmy Melskens[1], Amber Nusteling[2], Valerio Zardetto[3], Henk Schut[4], Wilhelmus M.M. Kessels[1,3], Stephan W.H. Eijt[2], and Mariadriana Creatore[1,3*]*

[†]*These authors contributed equally to this work.*

[1]Department of Applied Physics, Eindhoven University of Technology, 5600 MB Eindhoven, The Netherlands

[2]Fundamental Aspects of Materials and Energy, Department of Radiation Science and Technology, Delft University of Technology, 2629 JB Delft, The Netherlands

[3]Solliance Solar Research, High Tech Campus 21, 5656 AE Eindhoven, The Netherlands

[4]Neutron and Positron Methods in Materials, Department of Radiation Science and Technology, Delft University of Technology, 2629 JB Delft, The Netherlands

*Corresponding authors
E-mail: s.w.h.eijt@tudelft.nl, M.creatore@tue.nl

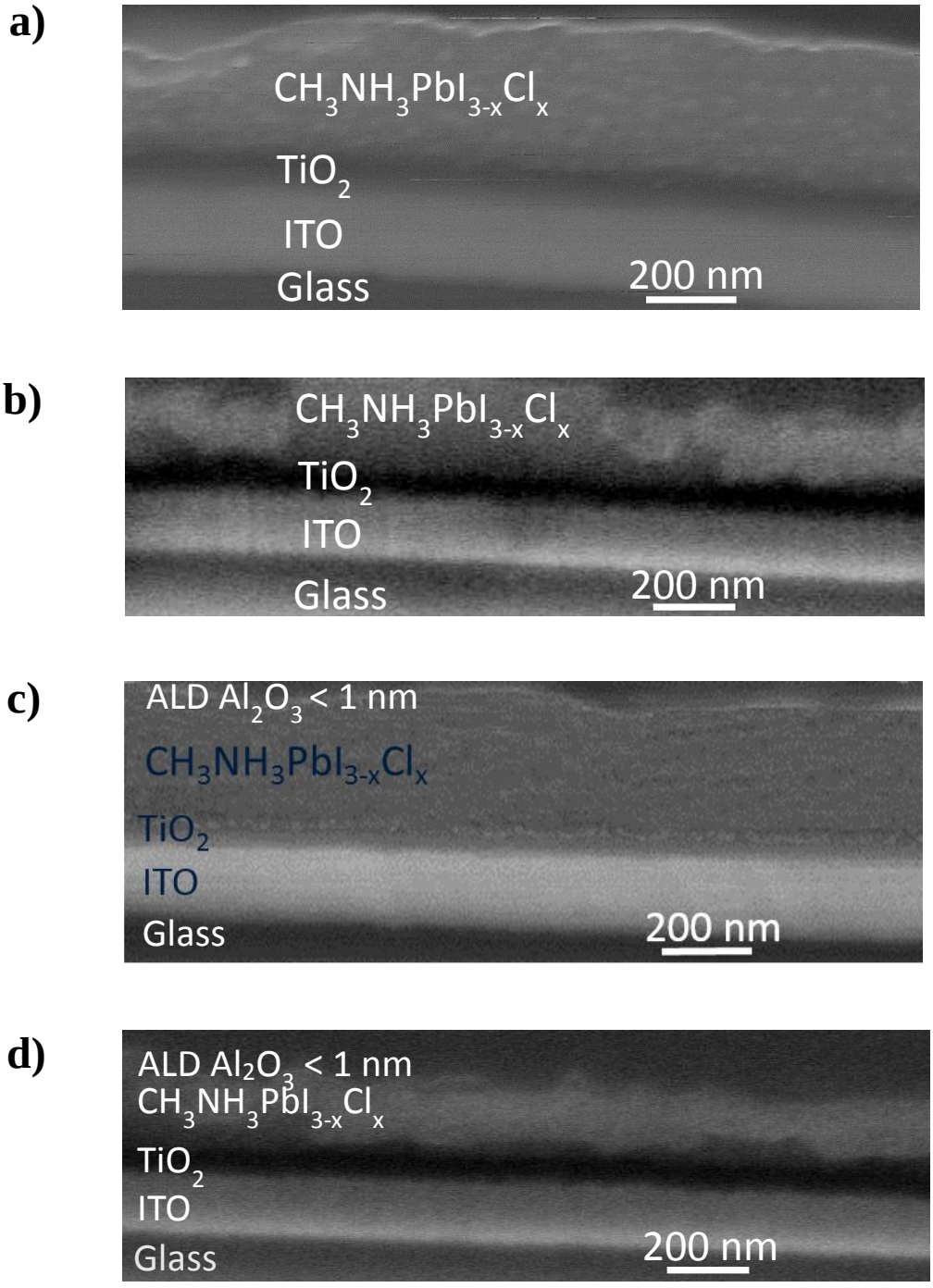

Figure S1. Cross-sectional SEM images of the stacks comprising of (a), (b) glass/ ITO/ TiO_2/ perovskite and (c), (d) glass/ ITO/ TiO_2/ perovskite/ALD Al_2O_3 (< 1 nm) taken at (a), (c) day 0 and (b), (d) after 22 days of air exposure (relative humidity of 40-55%) at room temperature. The images clearly show a reduction in the thickness of the perovskite layer upon air exposure.

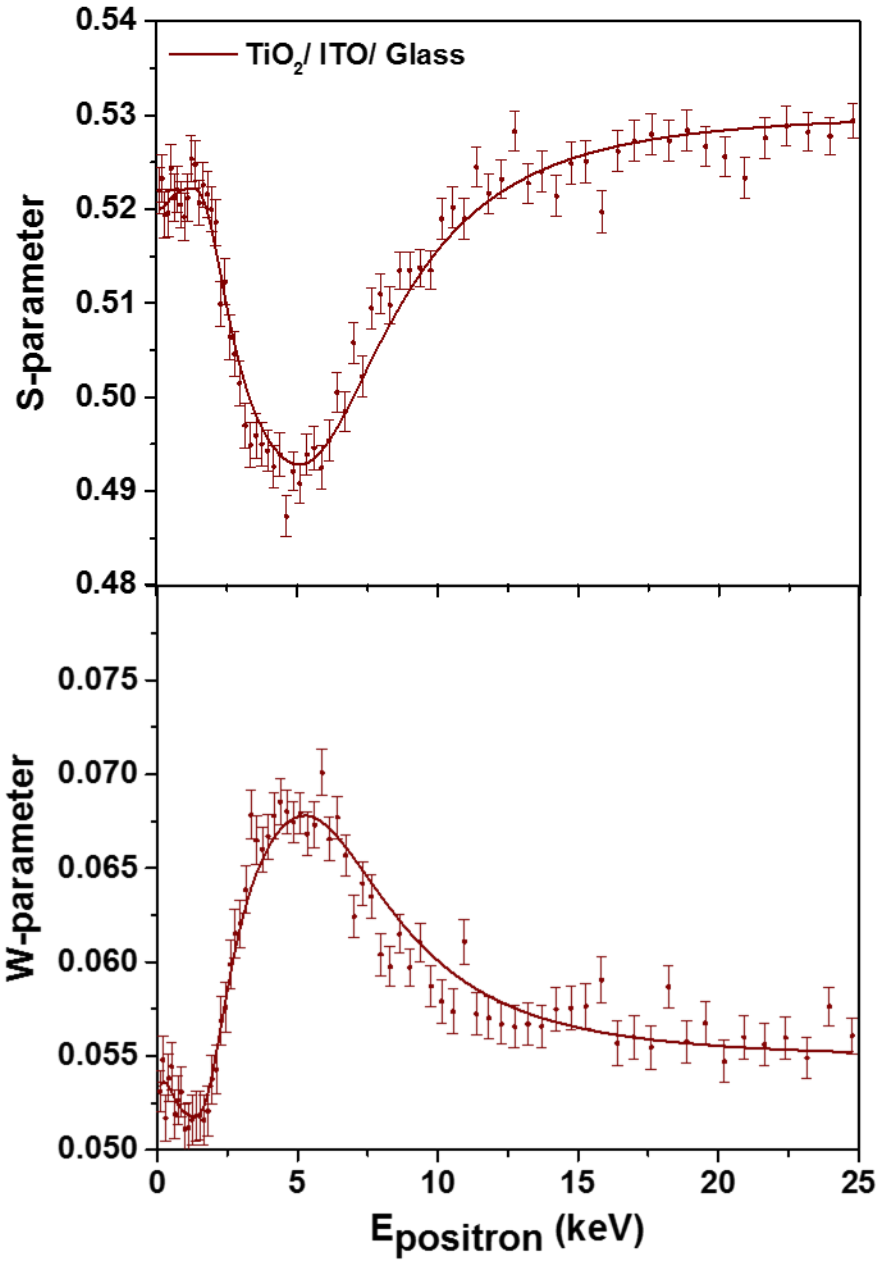

Figure S2. DB-PAS depth-profiles of *S*- and *W*-parameter of the 50 nm TiO_2 film on top of an ITO-coated glass substrate. Full lines are fit curves obtained by VEPFIT analysis.

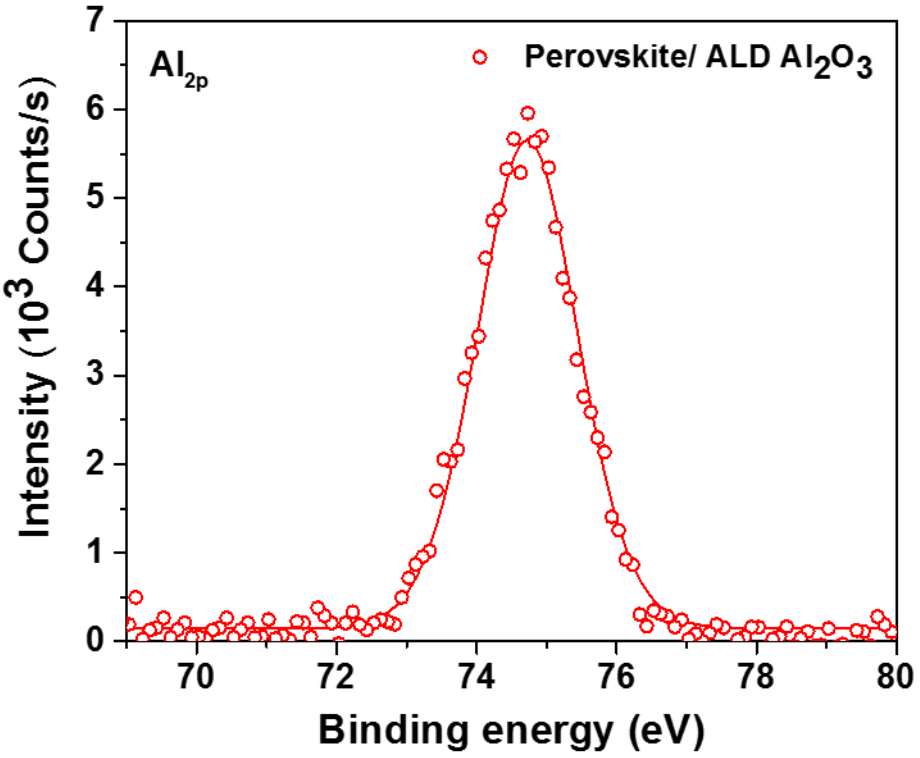

Figure S3. Surface XPS spectrum of Al2p peak of the perovskite/ALD Al_2O_3 film at day 0. Open circles and the solid line are measured data and peak fit, respectively.

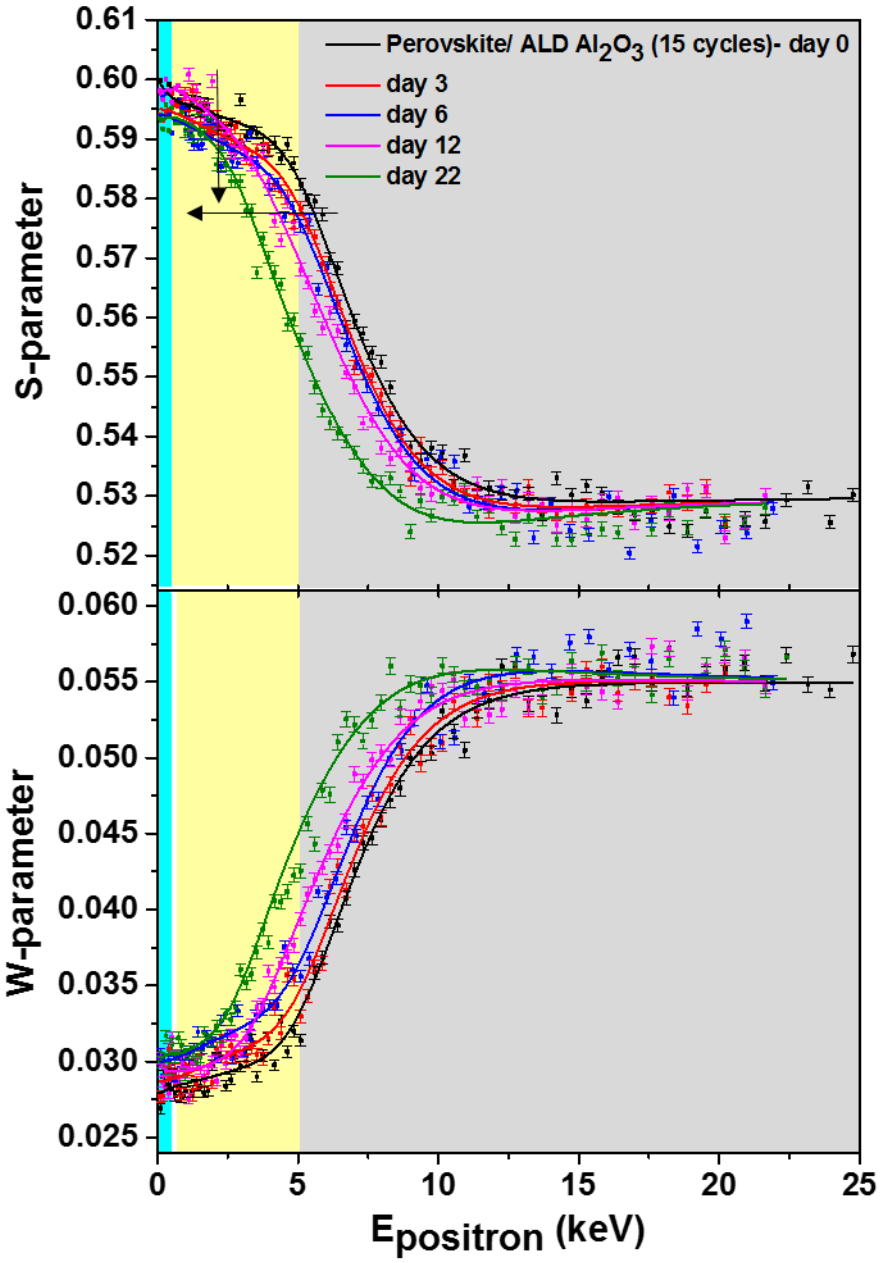

Figure S4. DB-PAS depth-profiles of *S*- and *W*-parameters of perovskite/ALD Al_2O_3 (15 cycles) film at day 0 and after 3, 6, 12 and 22 days of air exposure. Full lines are fit curves obtained by VEPFIT analysis. Blue region represents positron annihilation at the surface, yellow region represents positron annihilation in the perovskite film, and grey region represents increasingly larger fractions of the positrons annihilating in the TiO_2/ITO underlayers and the glass substrate.