

Supporting Information

A New Physical Deposition Approach for Low Cost Inorganic Hole Transport Layer in Normal Architecture of Durable Perovskite Solar Cells

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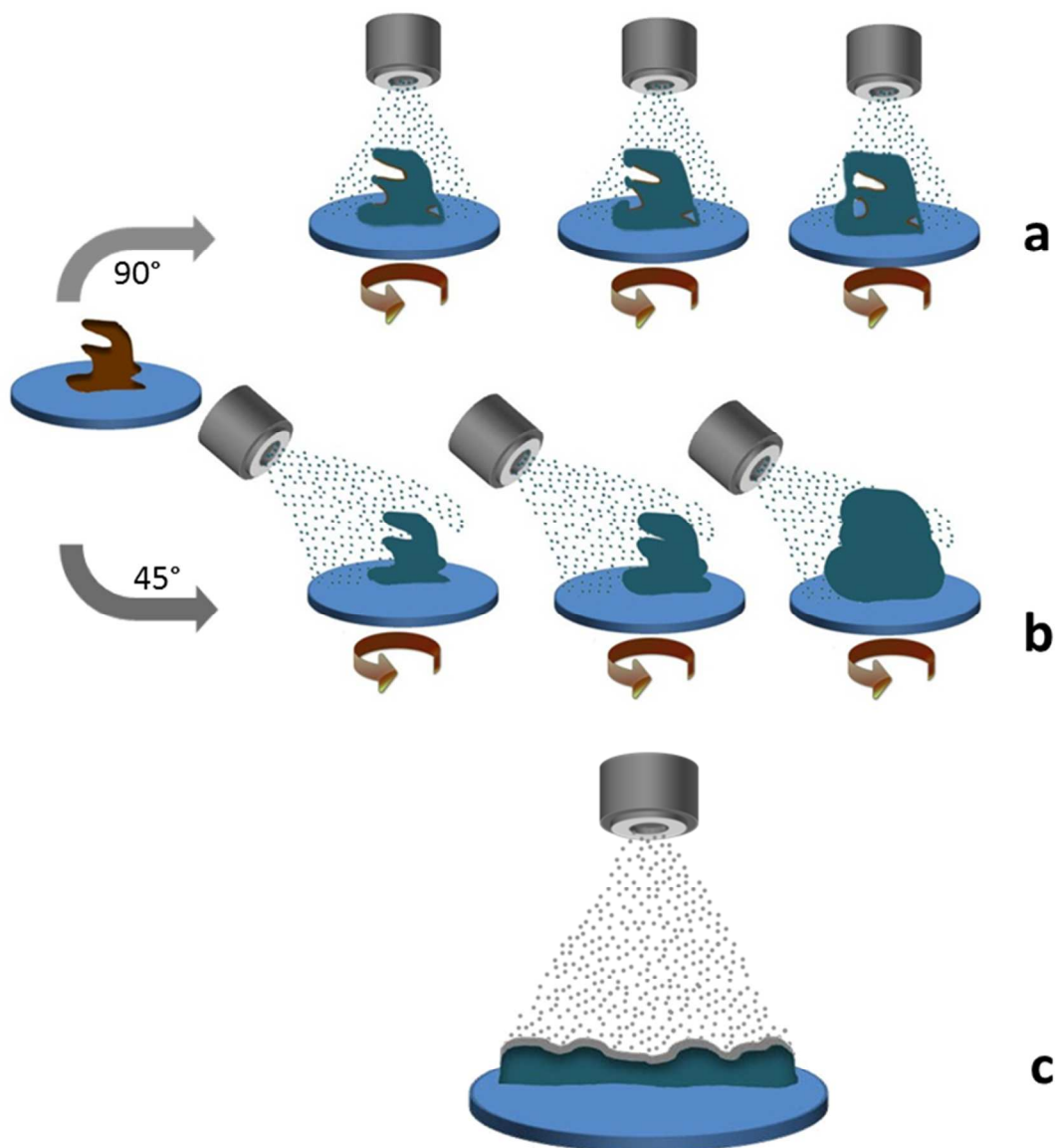


Figure S1. Deposition schematic of NiO_x (a, and b) and Ni (c) thin layers process on perovskite layer by magnetron sputtering. (a) Deposition of NiO_x layer on perovskite layer at rotating 90° deposition angle. (b) Deposition of NiO_x layer on perovskite layer at rotating 45° deposition angle. (c) Deposition of Ni contact layer on NiO_x layer at non-rotating 90° deposition angle.

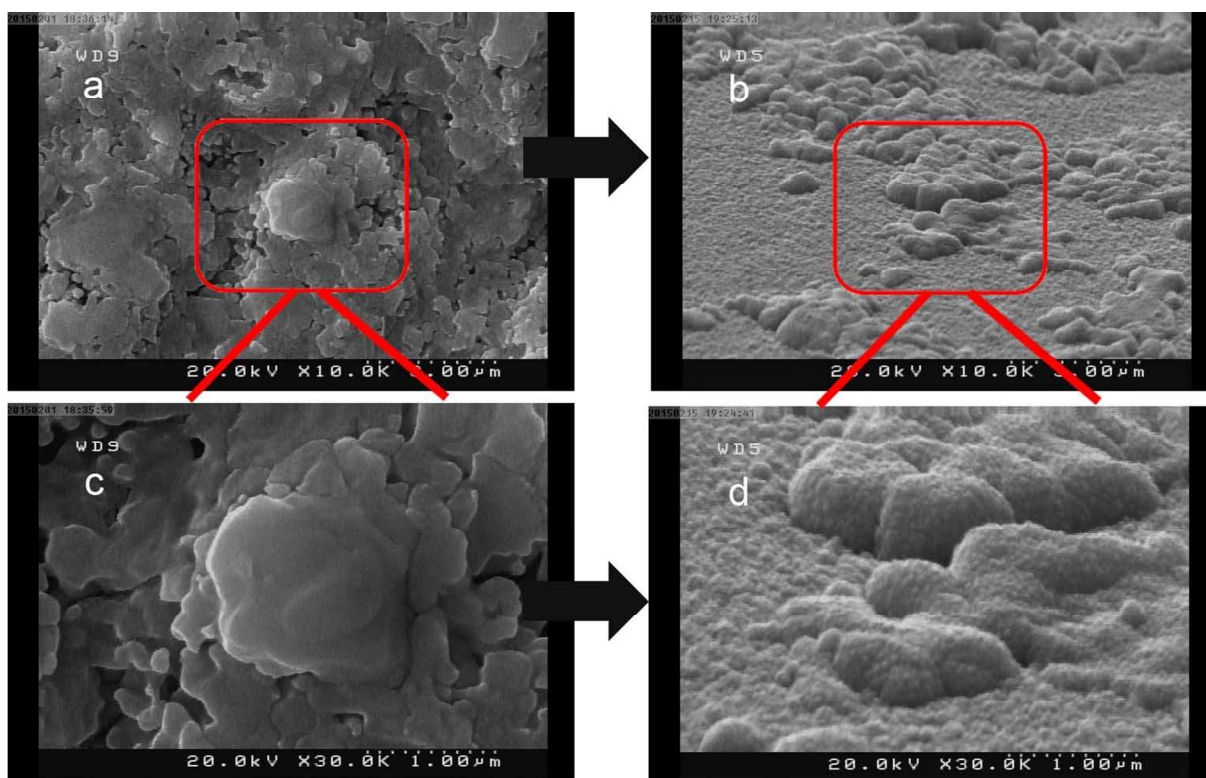


Figure S2 FE-SEM image of perovskite layer on TiO₂ layer (a, and c), and NiO_x electron blocking layer on perovskite layer (b, and d).

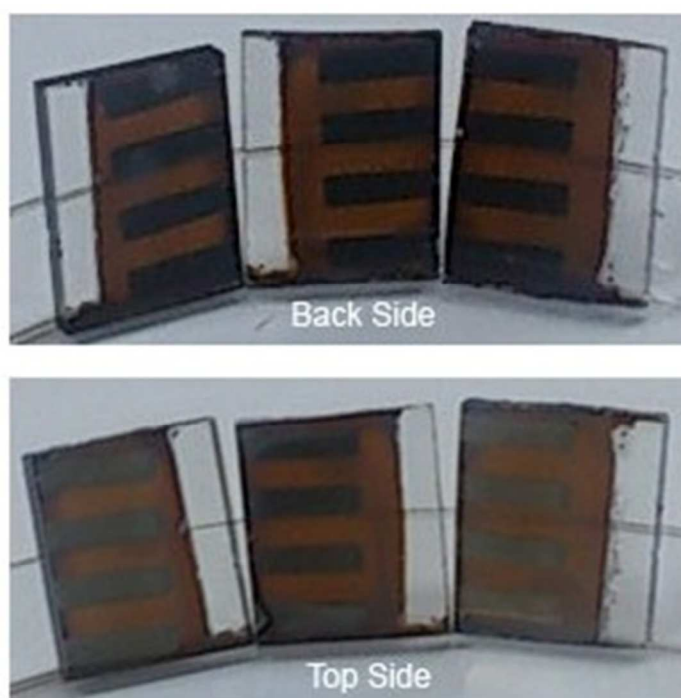


Figure S3 The photograph of back and top sides of FTO/TiO₂/CH₃NH₃PbI_{3-x}Cl_x/NiO_x/Ni

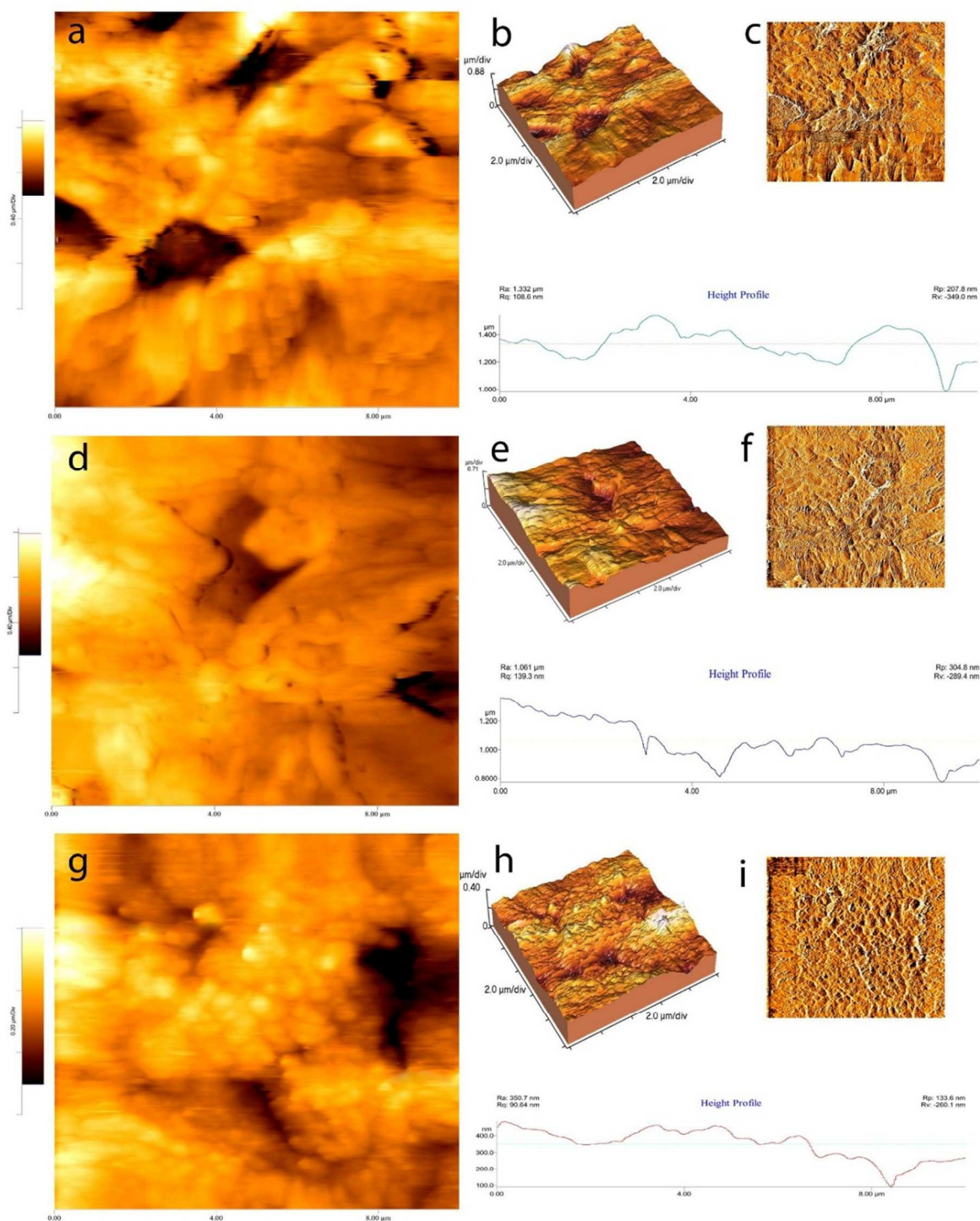


Figure S4. Tapping (a, b, d, e, g, and h) and phase analysis (c, f, and i) mode AFM images ($10 \times 10 \mu\text{m}$) of deposited perovskite layer on FTO/TiO₂ compact layer at 2000 rpm and annealed for 100 °C (a, b, and c), NiO_x layed on FTO/TiO₂/CH₃NH₃PbI_{3-x}Cl_x by rotating 45° tilted substrate reactive magnetron sputtering(d,e, and f), and nickel contact layer on FTO/TiO₂/CH₃NH₃PbI_{3-x}Cl_x/NiO_x layer by non-rotating 90° substrate reactive magnetron sputtering (g, h, and i)