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Hybrid perovskite crystals: surface restructuring under humid ambient

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Hybrid perovskites have emerged as an important class of semiconductors owing to their alluring optoelectronics properties. The device interface structure and surface chemistry of these crystals are key variables that determine the device's performance. Little is known about the fundamental underlying properties of the surfaces of perovskite materials because extrinsic effects, which include the processing conditions, complex microstructures and hydration under ambient conditions, that are thought to cause resistive losses and high leakage current in solar cells. The true intrinsic structural and optoelectronic properties of both pristinely cleaved and aged surfaces of single crystals are discussed. It is also identified that the surface restructuring on the aged surfaces (visualized on the atomic-scale by scanning tunneling microscopy) can lead to compositional and optical bandgap changes as well as degradation of carrier dynamics, photocurrent, and solar cell device performance. The insights are discussed to clarify the key variables involved in the performance of perovskite-based solar cells and fabrication of high-quality surface single crystals, thus paving the way toward their future exploitation in highly efficient solar cells.

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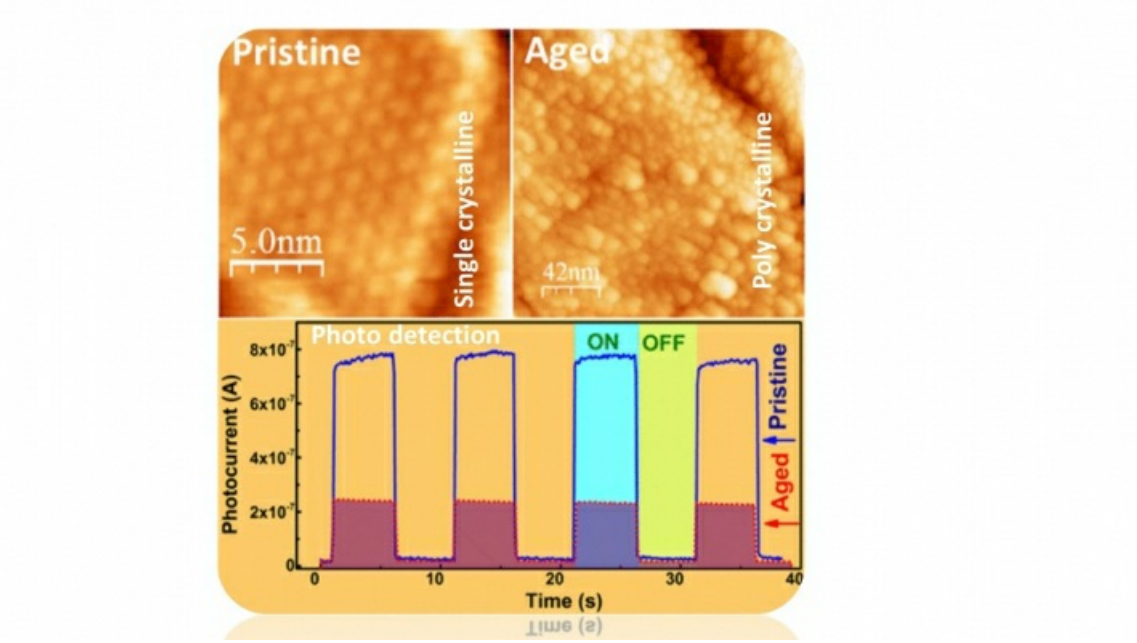

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