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From Synthesis to Application of Photovoltaic Perovskite Nanowires

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Abstract : The organolead halide perovskite CH3NH3PbI3 and its derivatives are known to be very efficient light harvesters revolutionizing the field of solid-state solar cells. The major research area in this field is photovoltaic device engineering although other applications are being explored, as well. Recently, we have shown that nanowires of this photovoltaic perovskite can be synthesized which in association with carbon nanostructures (carbon nanotubes and graphene) make outstanding composites with rapid and strong photo-response. They can serve as conducting electrodes, or as central components of detectors. The performance of several miniature devices based on these composite structures will be demonstrated. Our latest findings on the guided growth of perovskite nanowires by solvatomorph graphoepitaxy will be presented. This method turned out to be a fairly simple approach to overcome the spatially random surface nucleation. The process allows the synthesis of extremely long (centimeters) and thin (a few nanometers) nanowires with a morphology defined by the shape of nanostructured open fluidic channels. This low-temperature solution-growth method could open up an entirely new spectrum of architectural designs of organometallic-halide-perovskite-based heterojunctions and tandem solar cells, LEDs and other optoelectronic devices. Acknowledgment: This work is done in collaboration with Endre Horvath, Massimo Spina, Alla Arakcheeva, Balint Nafradi, Eric Bonvin1, Andrzej Sienkievicz, Zsolt Szekrenyes, Hajnalka Tohati, Katalin Kamaras, Eduard Tutis, Laszlo Mihaly and Karoly Holczer The research is supported by the ERC Advanced Grant (PICOPROP670918).

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