

Lead-free perovskite solar cells

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Halide perovskites quickly overran research activities in new materials for cost-effective and high-efficiency photovoltaic technologies. Since the first demonstration from Kojima and co-workers in 2007, several perovskite-based solar cells have been reported and certified with rapidly improving power conversion efficiency, now approaching their theoretical limit. Recent reports demonstrated that perovskites outperform the most efficient photovoltaic materials to date. At the same time, they still allow solution processing as a potential advantage in delivering a cost-effective solar technology.

The most stable and efficient perovskites contain lead, among the most toxic elements on earth. Lead-free alternatives have been reported with impressive progress in power conversion efficiency for tin-based (lead-free) perovskites. However, the stability of tin-based perovskite solar cells is still unexplored. In the present talk, I will focus on the stability of tin-based (lead-free) perovskite solar cells. I will show that tin oxidation during the processing of the device is the main source of instability, which we can prevent by avoiding the use non non-oxidizing solvents. Removing the source of tin oxidation, we observe that tin-based perovskite can achieve longer stability in working conditions than lead-based compositions.



Antonio Abate is the director of the “Novel Materials and interfaces for photovoltaic solar cells” department at the Helmholtz-Centrum Berlin in Germany. He is researching solar energy conversion with halide perovskites.

Before his current position, Antonio led solar cell research at the University of Fribourg in Switzerland as a team leader. He was a Marie Skłodowska-Curie Fellow at École Polytechnique Fédérale de Lausanne within the group of Prof. Grätzel. He worked for four years as a postdoctoral researcher at the University of Oxford under the supervision of Prof. Snaith and at the University of Cambridge under the supervision of Prof. Steiner.

Antonio graduated summa cum laude from the University of Naples Federico II in 2006. He got his PhD summa cum laude at Politecnico di Milano in 2011 under the supervision of Prof. Resnati and Prof. Metrangolo.

Antonio collected more than 5 M€ personal (including 1.5 M€ ERC starting grant – FREENERGY) and 7 M€ joint research funding as an independent researcher. He is listed in the top 1% by citations in the Web of Science (Highly Cited Researchers 2018, 2019, 2020, 2021, 2022), with more than 48 000 citations (h-index 83, according to Google Scholar) from over 150 peer-reviewed scientific publications. The World University Rankings indicated Antonio within the top 10 most influential scientists in the field of perovskite solar cells.