

Halide perovskites: from structure to electronic properties, to devices

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Halide perovskite semiconductors recently have experienced large scientific and technological interest due to their unique structural, electronic and optical properties, which make them well suited for optoelectronic applications such as solar cells and LEDs. The structural peculiarities of this material class on the one hand allows to design materials using a multitude of different organic and inorganic cations by low temperature (e.g. solution) processing, but on the other hand also requires to pay close attention to structural transformations and stability of the compounds. From a device perspective the most interesting optical and electrical properties of (in particular lead-based) halide perovskites are high absorption coefficients in the visible region and very low densities of electronic defects, leading to large lifetimes for photoexcited carriers. Despite relatively moderate carrier mobilities, these properties result in large carrier diffusion lengths and rather high quasi-Fermi level splittings, which makes them ideal candidates for efficient thin-film photovoltaics, with demonstrated single junction device efficiencies > 25%, and 29.5% in the cases Si/perovskite tandem devices.