

Why do perovskite solar cells have large polarons?

Recent investigations have revealed that these appealing properties were endowed due to the formation of large polarons in the perovskite crystals, resulting from the coupling of photogenerated carriers and a polarized crystal lattice, which largely affected the carrier-transport dynamics and structural stability of perovskite solar cells (PSCs).

Why is polaron formation important in halide perovskites?

The details of polaron formation are crucial for carrier transport since polaron formation leads to a larger effective mass of a carrier. Several mechanisms have been proposed regarding the physics of polaron formation in halide perovskites, but the details are still under active debate.

Are charge carriers protected as large polarons in hybrid organic-inorganic lead halide perovskites?

Zhu, X. Y. & Podzorov, V. Charge carriers in hybrid organic-inorganic lead halide perovskites might be protected as large polarons. *J. Phys. Chem. Lett.* 6, 4758-4761 (2015). Chen, Y. et al. Extended carrier lifetimes and diffusion in hybrid perovskites revealed by Hall effect and photoconductivity measurements. *Nat. Commun.* 7, 12253 (2016).

Are polaron states modulated in PSCs?

Then, the modulation of polaron states in PSCs, including large polaron stabilization, polaron-facilitated charge transport, hot-carrier solar cells, and polaron-related stability issues such as polaron-induced metastable defects, polaronic strain, and photostriction are systematically investigated.

What is the prototypical model of a large polaron?

The prototypical model of the large polaron was proposed by H. Fröhlich⁴². Note that a large polaron is formed by long-range interactions and is characterized by coherent transport. Conversely, a small polaron is localized within a single site and is usually formed by short-range electron-phonon interactions.

Do polarons affect PSC performance and photostability?

Therefore, the presence of polarons in PSCs has a great influence on device performance and photostability, which merits more investigations, including the understanding of their formation mechanism and the development of polaron manipulation, working toward high-performance PSCs [37,38].

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Successful implementation of hot carrier solar cells requires preserving high carrier temperature as carriers migrate through the active layer. Here, we demonstrated that addition of alkali cations in hybrid organic ...

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Then, the modulation of polaron states in PSCs, including large polaron stabilization, polaron-facilitated charge transport, hot-carrier solar cells, and polaron-related stability issues such as polaron-induced metastable defects, polaronic strain, and photostriction are systematically investigated. Finally, the prospect of further ...

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