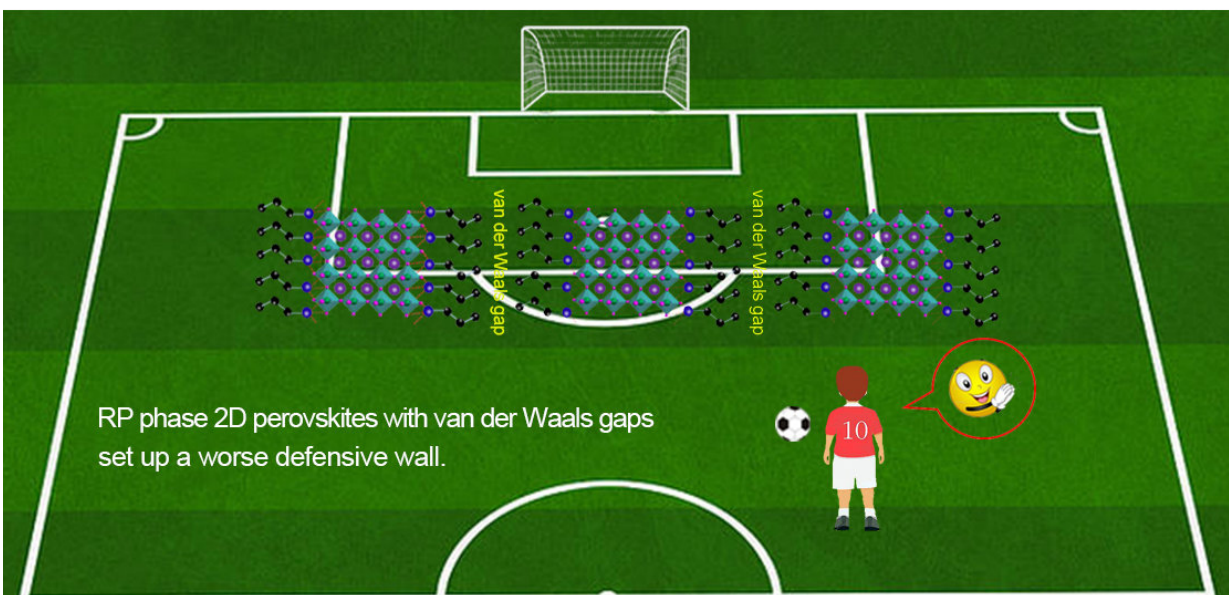
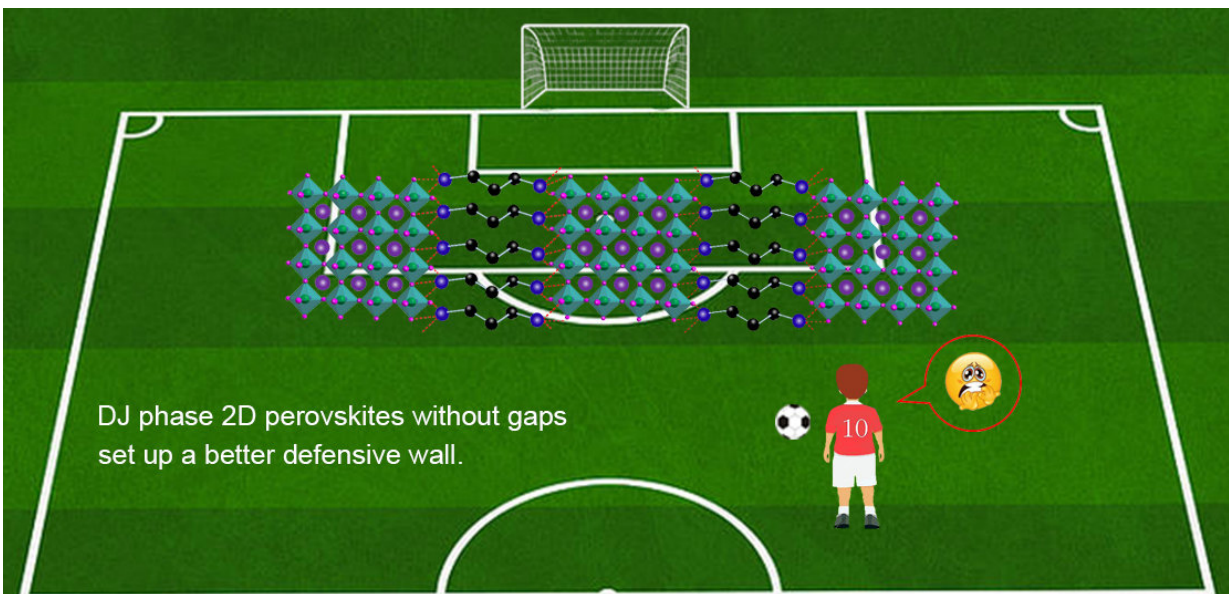


Stabilizing 2-D layered perovskites for photovoltaics: Setting up a defensive wall

December 21 2018



Comparison of RP and DJ phase 2D layered perovskite structures. Credit: DICP

Setting up a defensive wall in a soccer game is a primary sports challenge. No coach likes a gap between defensive players in the wall. Scientists are tackling a similar problem to improve the stability of perovskite solar cells (PSCs).

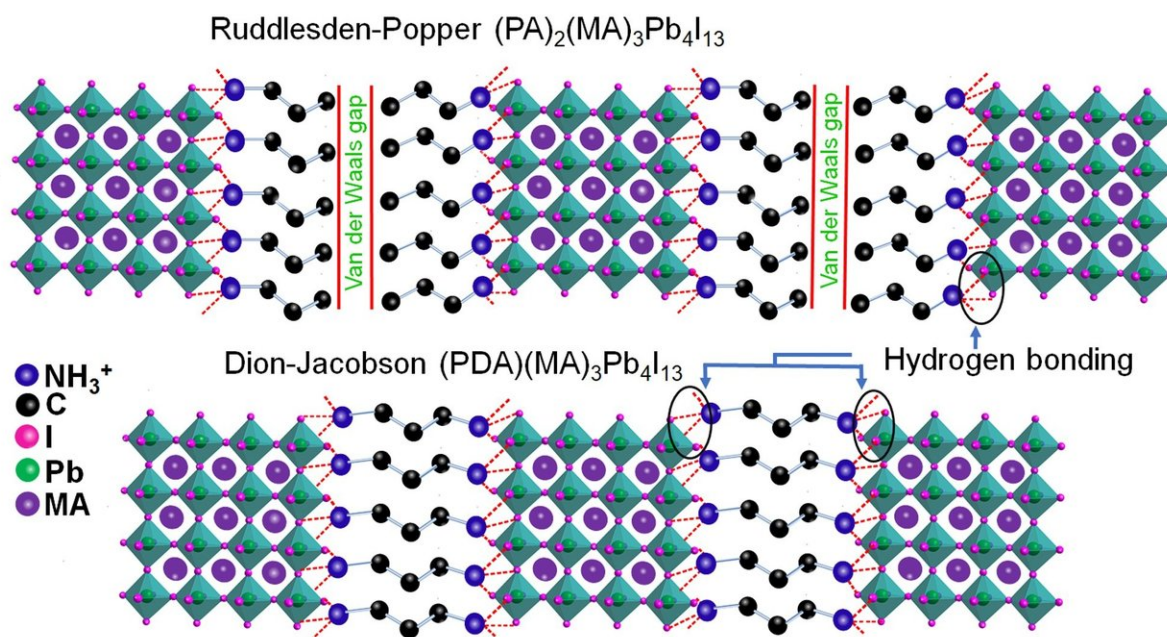
A [research team](#) led by Prof. Guo Xin and Prof. Li Can from the Dalian Institute of Chemical Physics (DICP) of the Chinese Academy of Sciences (CAS) improved the [stability](#) of PSCs by removing the van der Waals gaps in a widely studied Ruddlesden-Popper (RP)-phase, two-dimensional (2-D), layered [perovskite](#) materials.

The newly developed materials are a series of Dion-Jacobson (DJ) phase 2-D layered perovskites, which, without gaps, have an extremely stable structure and can defend against attacks from moisture, heat and light more efficiently, leading to outstanding stability of PSCs under harsh testing conditions. The team's findings were published in *Joule* on Dec 21.

PSCs have shown great promise for next-generation [photovoltaics](#). However, their instability limits further development because of the poor structural stability of conventional 3-D organic-inorganic hybrid perovskites, which are usually used as the light-harvesting materials in PSCs.

The 2-D layered perovskites have attracted a lot research interest in recent years because they offer better stability than traditional 3-D analogues. In most cases, the term "2-D layered perovskites" refers to RP phase ones, in which van der Waals gaps are present. These gaps create weak interactions between layers, thus lessening the stability of

the layered perovskite structure and the device.



Comparison of RP and DJ phase 2D layered perovskite structures. Credit: DICP

"In contrast with the RP case, our DJ phase 2-D layered perovskites are formed by alternating hydrogen bonds between organic layers and inorganic layers with no gaps, which makes their structure more stable," said Prof. Guo.

"External stresses like moisture, heat and light cannot easily degrade such materials. This is just like a defensive wall in a soccer game. Imagine that each defensive player is an organic layer or an inorganic layer in 2-D layered perovskites. If they stand next to each other in a row, the kicker cannot easily make a goal. If there are gaps between players in the wall, the kicker can score easily, which is just like the situation in RP 2-D layered perovskites," Guo explained.

More energy from external stresses is needed to degrade DJ phase 2-D perovskites than their RP counterparts. As in a soccer game, a banana kick has to be made to bypass a good defensive wall, so it is more difficult for the kicker.

"Indeed, the PSCs fabricated using our materials exhibited more outstanding stability than those using 3-D and RP phase 2-D perovskites," said Prof. LI. "Our unsealed devices can maintain 95 percent of initial efficiency upon exposure to various harsh stresses, including being stored in ambient air for 4,000 hours, heated at 85 oC with relative humidity of 85 percent for 168 hours, and continuously illuminated for 3,000 hours."

"The highest efficiency we obtained from the PSCs made from our 2-D perovskites is just over 13 percent. Although this is one of the highest values among 2-D PSCs, it lags behind the state-of-the-art efficiency of 3-D PSCs. Therefore, more effort needs to be made to further improve the efficiency of these 2-D PSCs," the DICP researchers said in their report.

More information: *Joule* (2018). [DOI: 10.1016/j.joule.2018.11.026](https://doi.org/10.1016/j.joule.2018.11.026)

Provided by Chinese Academy of Sciences

Citation: Stabilizing 2-D layered perovskites for photovoltaics: Setting up a defensive wall (2018, December 21) retrieved 9 April 2024 from <https://phys.org/news/2018-12-stabilizing-d-layered-perovskites-photovoltaics.html>

<p>This document is subject to copyright. Apart from any fair dealing for the purpose of private study or research, no part may be reproduced without the written permission. The content is provided for information purposes only.</p>
