NYCU Develops a Stable Perovskite Solar Cell in a Transnational Collaboration with a Saudi Team, Marking a Milestone for Energy Sustainability

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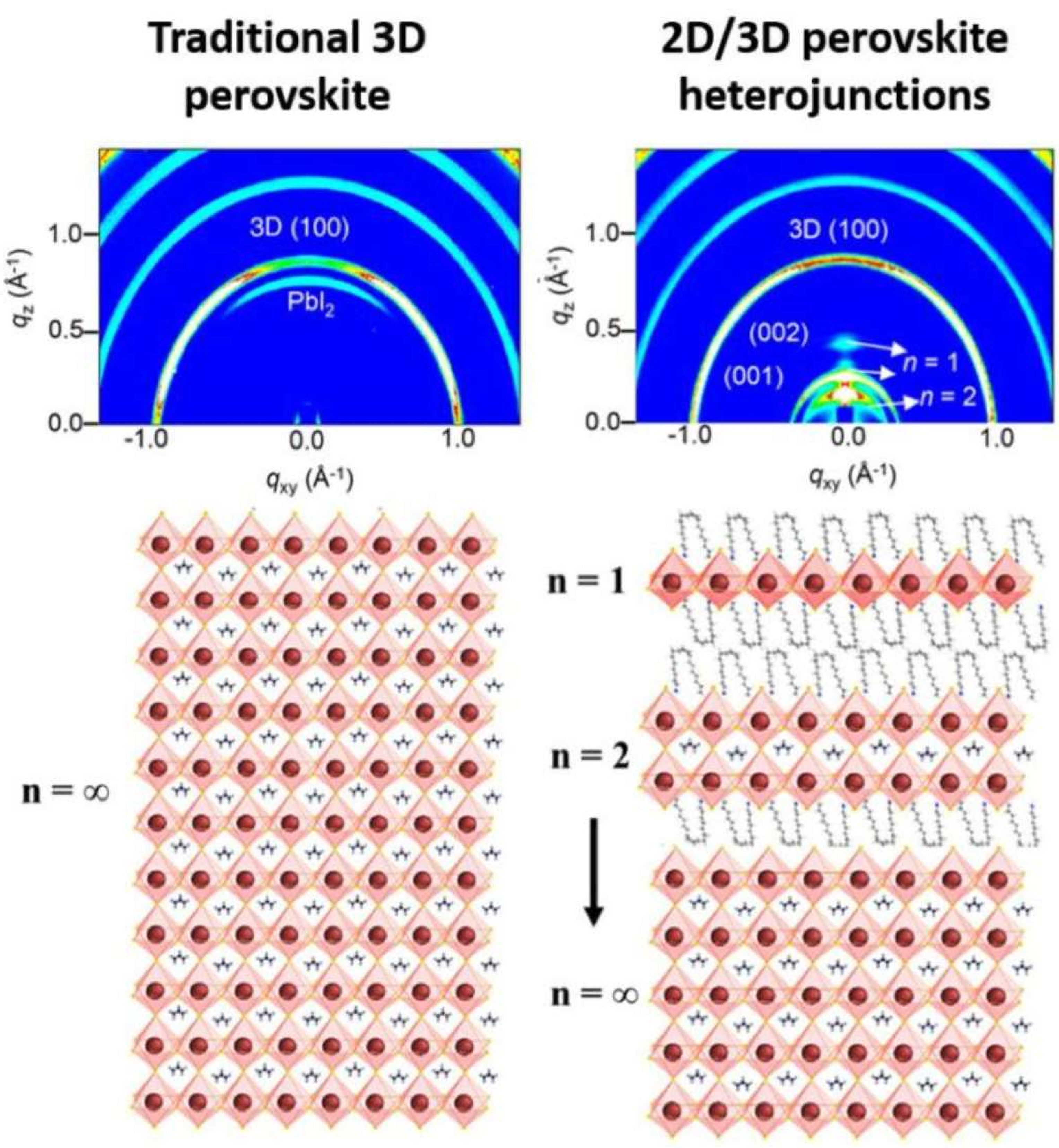
Energy transition plays a critical role in humans' sustainable development. An NYCU team led by Chien-Lung Wang, a professor at the Department of Applied Chemistry, collaborated with a Saudi team led by Prof. Stefaan De Wolf at King Abdullah University of Science and Technology Solar Center in successfully developing a stable perovskite solar cell (PSC), paving the way to the commercialization of next-generation solar cells. This breakthrough has been published in the top journal *Science*.

Solar energy has been considered an ideal form of renewable energy because it is nearly inexhaustible. In recent years, the power conversion efficiency (PCE) of commercial solar cell modules has grown stably to approximately 20%. With >22% PCE and reasonable manufacturing cost, PSCs have become a critical research direction in next-generation solar cell development. However, PSCs' low environmental stability has continued to prevent their commercialization. The long-term stability of PSCs must first be realized.

In his recent study titled "Damp heat–stable perovskite solar cells with tailored-dimensionality 2D/3D heterojunctions," Prof. De Wolf employed 2D/3D composite active layers to passivate the interface between the electron transport layer and the active layer of PSCs, solving the lack of long-term stability in conventional 3D PSCs. The 2D/3D composite PSCs provide 24.3% PCE. More importantly, they retain 95% of their initial efficiency after 1,000 hours of accelerated aging under high humidity and heat.



In the new PSCs, the 2D/3D composite nanostructure plays a major role in component performance and stability. In this research project, Prof. Wang and his master's student Yuan Chen succeeded in analyzing this nanostructure using the grazing-incidence wide-angle x-ray scattering technology developed by the National Synchrotron Radiation Research Center, providing an empirical reference for distinguishing 2D/3D composite PSCs and conventional 3D PSCs according to their film morphology. The new component design and elaborate nanostructure analysis are a key basis for PSC commercialization.

The successful transnational collaboration between NYCU and King Abdullah University of Science and Technology has contributed to the commercialization of next-generation solar cells. This will also encourage further transnational and interdisciplinary collaborations on energy sustainability.