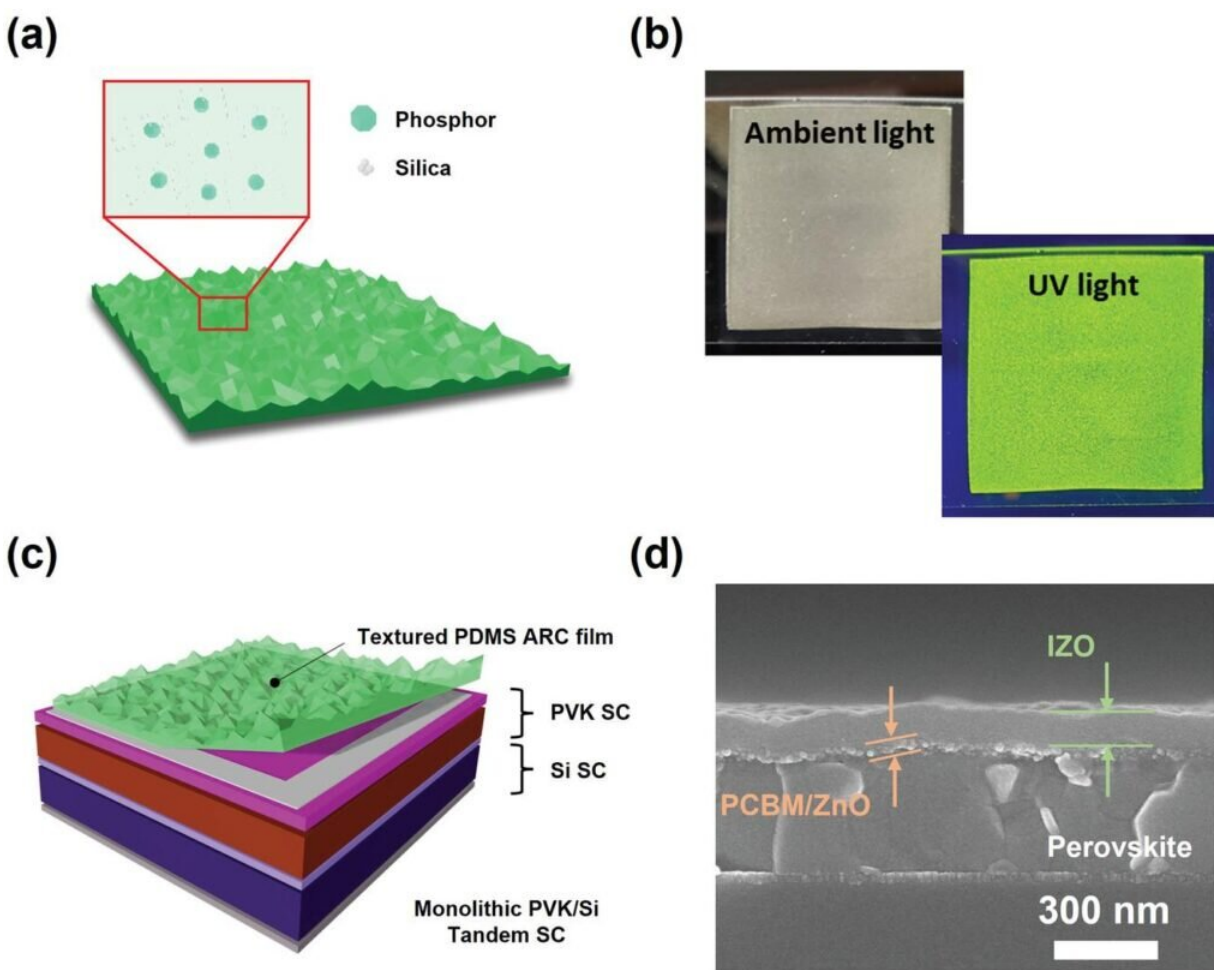


# New study finds ways to improve light absorption in perovskite/Si tandem solar cells

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(a) A schematic of the PDMS layer containing SGA phosphors and SiO<sub>2</sub> nanoparticles, (b) photographs of the PDMS layer with SGA phosphors and SiO<sub>2</sub> nanoparticles under ambient light and UV light ( $\lambda = 365$  nm), (c) a schematic of perovskite/Si tandem solar cell with the PDMS layer containing SGA phosphors and SiO<sub>2</sub> nanoparticles, and (d) a cross-sectional SEM image of

the perovskite–Si solar cell. Credit: UNIST

A research team, affiliated with UNIST has succeeded in achieving a power conversion efficiency (PEC) of 23.50% in a perovskite-silicon tandem solar cell built with a special textured anti-reflective coating (ARC) polymeric film. According to the research team, the PCE of the device with the ARC film was sustained for 120 hours, maintaining 91% of its initial value.

This breakthrough has been led by Professor Kyoung Jin Choi and his research team in the Department of Materials Science and Engineering at UNIST, in [collaboration](#) with Professor Jung-Kun Lee and his research team from the University of Pittsburgh in the United States.

In the work, the research team systematically demonstrated that a combination of silicon dioxide ( $\text{SiO}_2$ ) [nanoparticles](#) and large phosphor particles can convert ultraviolet (UV) to [visible light](#) and increase total transmittance of ARC film. Their experimental and computational results also show that  $\text{SiO}_2$  nanoparticles in the ARC film decrease the reflectance by increasing the diffuse transmittance.

Moreover, the PCE of the device with the ARC film was sustained for 120 hours, maintaining 91% of its initial value, while the PCE of existing devices dropped to 90% of its initial efficiency after 5 hours, and then decreased to 50% after 20 hours. In addition, the initial efficiency of the solar cell has also increased by nearly 4.5% compared to the previous one.

"This optically engineered ARC film successfully promotes the light absorption of the perovskite/silicon tandem solar cell, leading to the improvement of [power conversion efficiency](#) of the [tandem](#) cell from

22.48% to 23.50%," noted the research team.

The findings are published in *Advanced Functional Materials*.

**More information:** Seongha Lee et al, Improving Light Absorption in a Perovskite/Si Tandem Solar Cell via Light Scattering and UV-Down Shifting by a Mixture of SiO<sub>2</sub> Nanoparticles and Phosphors, *Advanced Functional Materials* (2022). [DOI: 10.1002/adfm.202204328](https://doi.org/10.1002/adfm.202204328)

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