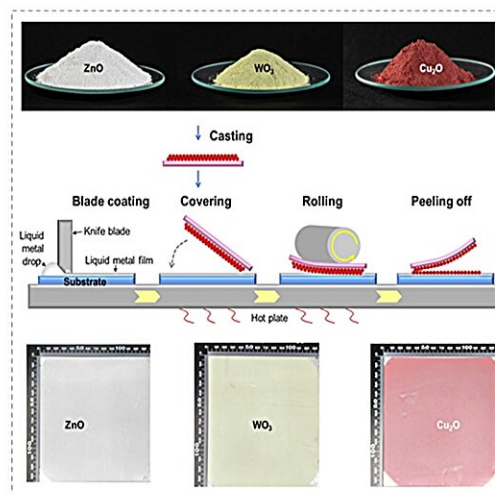
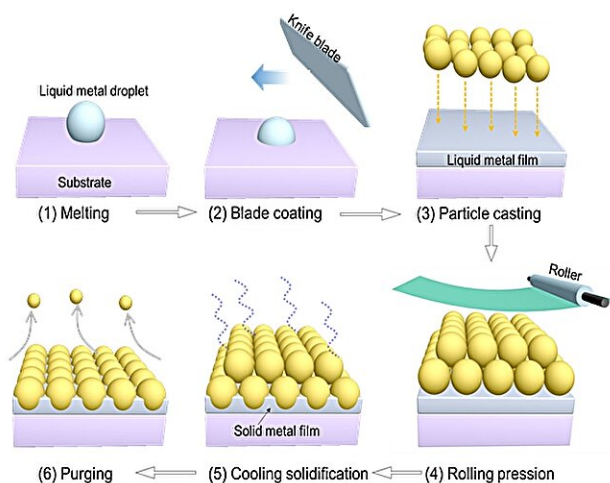


Scientists develop liquid metal-embraced photoactive films for artificial photosynthesis

February 28 2024, by Zhang Nannan



PiP process for the scalable fabrication of photoactive films. Credit: IMR

Solar-driven photocatalytic or photoelectrochemical water splitting holds great promise for direct solar-to-hydrogen energy conversion, especially in the context of the carbon-neutral initiative, while its practical applications hinge on significant advances in the scalable production of robust and efficient photoactive films.

A research team led by Prof. Liu Gang from the Institute of Metal Research (IMR) of the Chinese Academy of Sciences has developed a brand-new particle-implanting (PiP) technique to embed photoactive

semiconductors in liquid metal films for the scalable fabrication of robust and efficient photoactive films, inspired by the fact that photosystems I and II are embedded in the thylakoid membranes of chloroplasts in plant leaves to efficiently drive photosynthesis in nature.

This work is [published](#) in *Nature Communications*.

Like the living leaf, the film converts solar energy directly into a chemical fuel. Under simulated sunlight irradiation, its photocatalytic activity for water splitting to produce hydrogen is 2.9 times that of traditional films. Moreover, the liquid metal-embraced photoactive semiconductor films have good stability and scalability. The activity remains constant during long-term (>100 hours) continuous operation, more than 95% even after experiencing 10^5 bending cycles, and about 70% when scaled up to 64 cm^2 .

The excellent performance can be attributed to the three-dimensional [semiconductor](#)/metal [strong interaction](#), which enables efficient collection of photogenerated charges, strong architectural stability and superior photoactivity.

In addition, the film has the advantages of universality and recyclability, a wide range of low-melting-point metals (LMP) and semiconductors can be used and easily recycled via ultra-sonication in hot water. Overall, the LMP metal-based PiP technique offers a new opportunity for [solar energy](#) conversion devices and applications.

More information: Chao Zhen et al, Liquid metal-embraced photoactive films for artificial photosynthesis, *Nature Communications* (2024). [DOI: 10.1038/s41467-024-46073-6](https://doi.org/10.1038/s41467-024-46073-6)

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