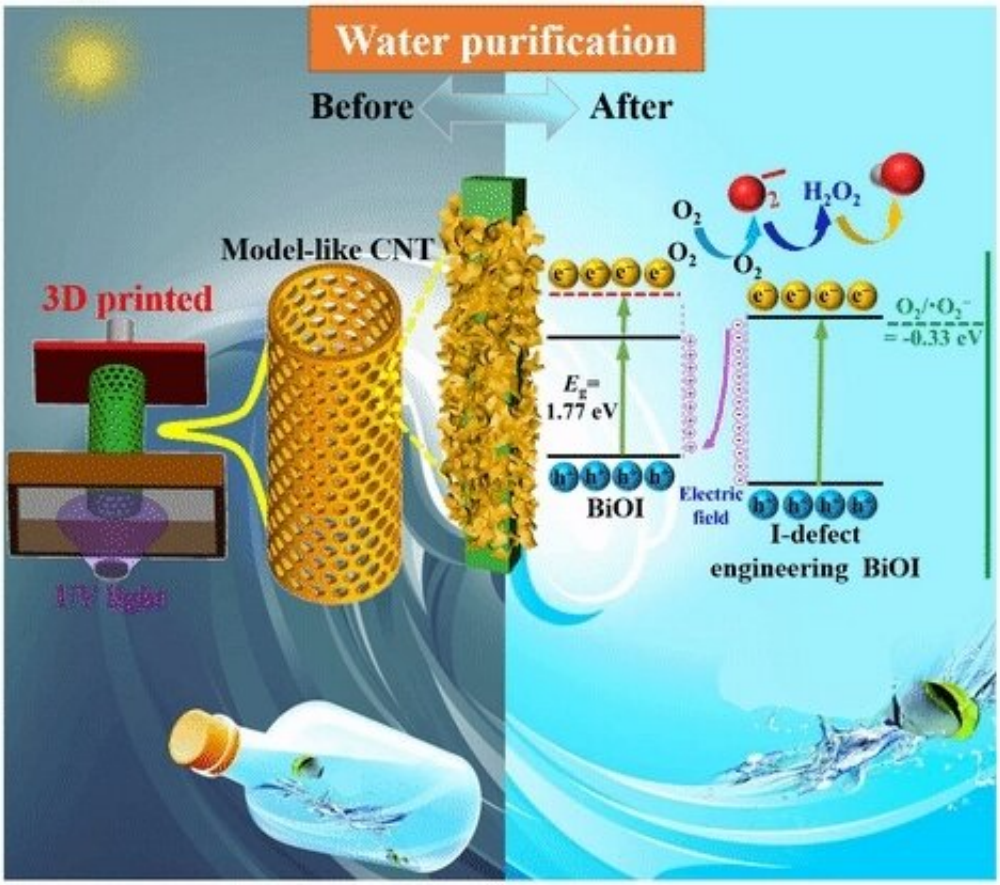
3D-printed polymer substrate coated with photocatalytic film developed for efficient water purification

May 11 2023, by Li Yuan



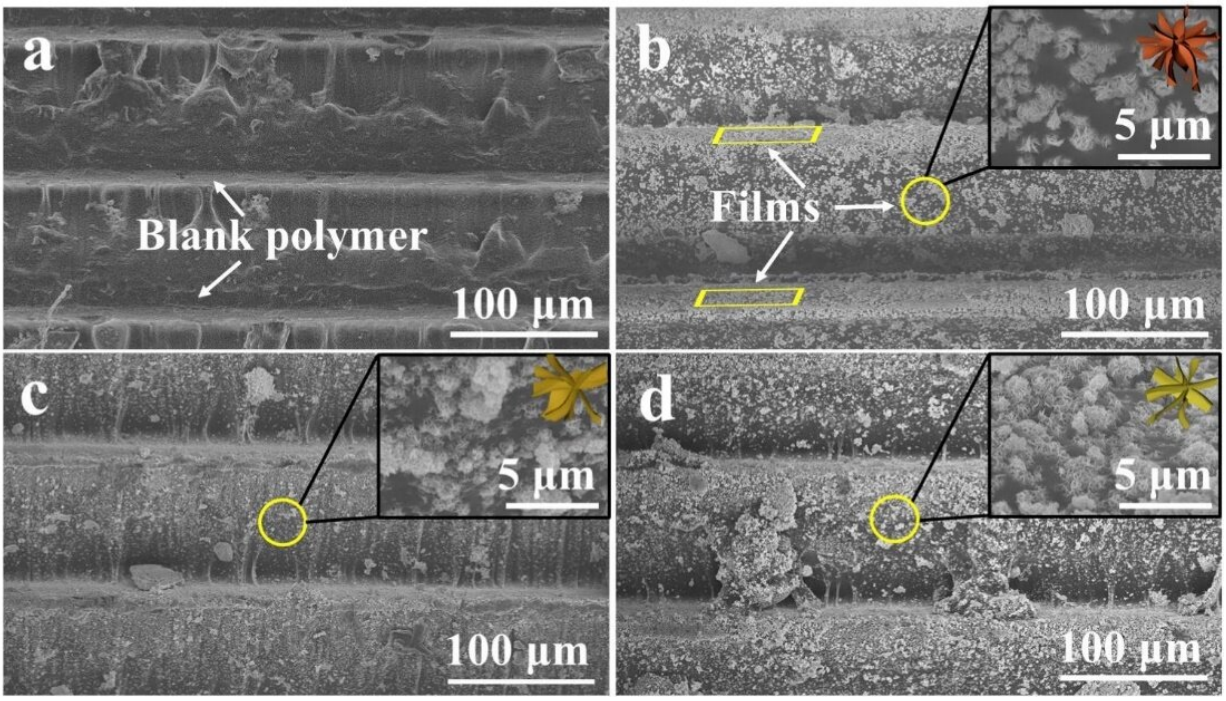
The scheme of in-situ photocatalytic film on 3D-printed polymer as an efficient purification application. Credit: IOCAS

A research team led by Prof. Zhang Dun from the Institute of

Oceanology of the Chinese Academy of Sciences (IOCAS) has developed a novel in-situ growth, bismuth oxyiodide (BiOI) film on a 3D-printed polymer substrate through successive ion layer adsorption reaction (SILAR) for water purification. The study was published in *Separation and Purification Technology* on May 4.

The researchers found that the substrate was completely covered with floriform microstructure film. They introduced OH^-/I substitution strategy to fabricate iodine-defects engineering BiOI film. The superficial color of the 3D-printed substrates ordinally changed from gloss white to brownish yellow, dark yellow, and light yellow, which was ascribed to the change of band gap caused by iodine-defect engineering film.

During the growing process of films, iodine spaces were introduced into the BiOI crystals, increasing BiOI internal electric field and electron density and improving photoinduced carrier separation and transmission efficiency. Iodine-defects engineering BiOI exhibited smaller grain size, higher specific surface area, electronegativity, photoelectric response and photocatalytic activity than stoichiometry BiOI.



Scanning electron microscopy (SEM) images of (a) the blank polymer substrate and I-defect engineering films fabricated at (b) pH 2.48, (c) pH 4~6, (d) pH 6~9. Credit: IOCAS

The researchers proposed that Bi^{3+} firstly adsorbed on polymers to construct the active grown sites of the film. With the extension of time, the films gradually self-assembled into petal-like BiOI film. High proportion and movement speed of I^- promoted the in-situ growth of BiOI film along the crystal plane.

"The film exhibits good photocatalytic activity and cyclic stability on photodegrading organic compounds and sterilizing microorganism," said Xu Xuelei, first author of the study.

More information: Xuelei Xu et al, In-situ growth pH-adjusted iodine defects engineering BiOI film on 3D-printed polymer substrate for

efficient organic pollutant and microorganism purification, *Separation and Purification Technology* (2023). DOI: 10.1016/j.seppur.2023.123974