CuInS2/TiO2 photoanode composites perform well in photo-induced cathodic protection

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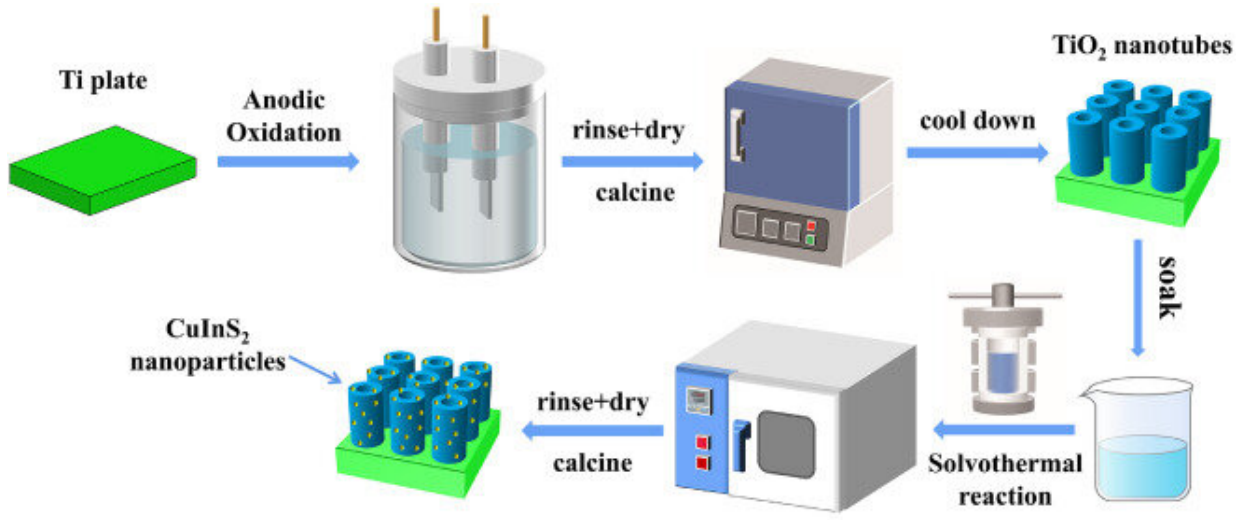

Graphical abstract. Credit: *Journal of Materials Science & Technology* (2022). DOI: 10.1016/j.jmst.2022.02.011

Photogenerated cathodic protection technology as a valuable branch of photocatalysis and photoelectrochemistry has played a pivotal role in mitigating marine corrosion.

Recently, a research team led by Prof. Wang Jing from the Institute of Oceanology of the Chinese Academy of Sciences (IOCAS) provided new insights into the elevated photo-induced cathodic protection of

$CuInS_2/TiO_2$ (CIS-9/T) photoanode composites for 304 stainless steel (304 SS) in simulated seawater.

The study was published in *Journal of Materials Science & Technology* on Mar. 21.

The researchers used immersion, in-situ growth of quantum dots and calcination to sensitize the TiO_2 substrate. They found a possible efficient photo-induced cathodic protection mechanism via photoelectrochemical tests.

Specifically, the oxidated Ti surface was pretreated in L-cysteine (L-cys) solution for couple of days to display sulfhydryl groups for coordinating with heavy metal ions to facilitate the in-situ growth of $CuInS_2$ quantum dots.

"The deposition of $CuInS_2$ on TiO_2 will boost the photoelectric conversion efficiency of the composite film and improve the photosensitivity," said Prof. Wang.

The researchers compared six open-circuit potential curves, and found that the CIS-9/T photoanode provided the best photogenerated cathodic protection for 304 SS.

They also found that numerous heterojunction electric fields were constructed owing to the excellent energy band matching between $CuInS_2$ and TiO_2. During several irradiation intervals, electrons could migrate uni-directionally to the 304 SS surface to achieve cathodic polarization.

"The immersion pretreatment operation in our work provides favorable conditions for the growth of quantum dots, and thus shows better anticorrosion performance together with TiO_2," said Dr. Wang Ning,

first author of the study.

More information: Juan Liu et al, CuInS2/TiO2 heterojunction with elevated photo-electrochemical performance for cathodic protection, *Journal of Materials Science & Technology* (2022). DOI: 10.1016/j.jmst.2022.02.011