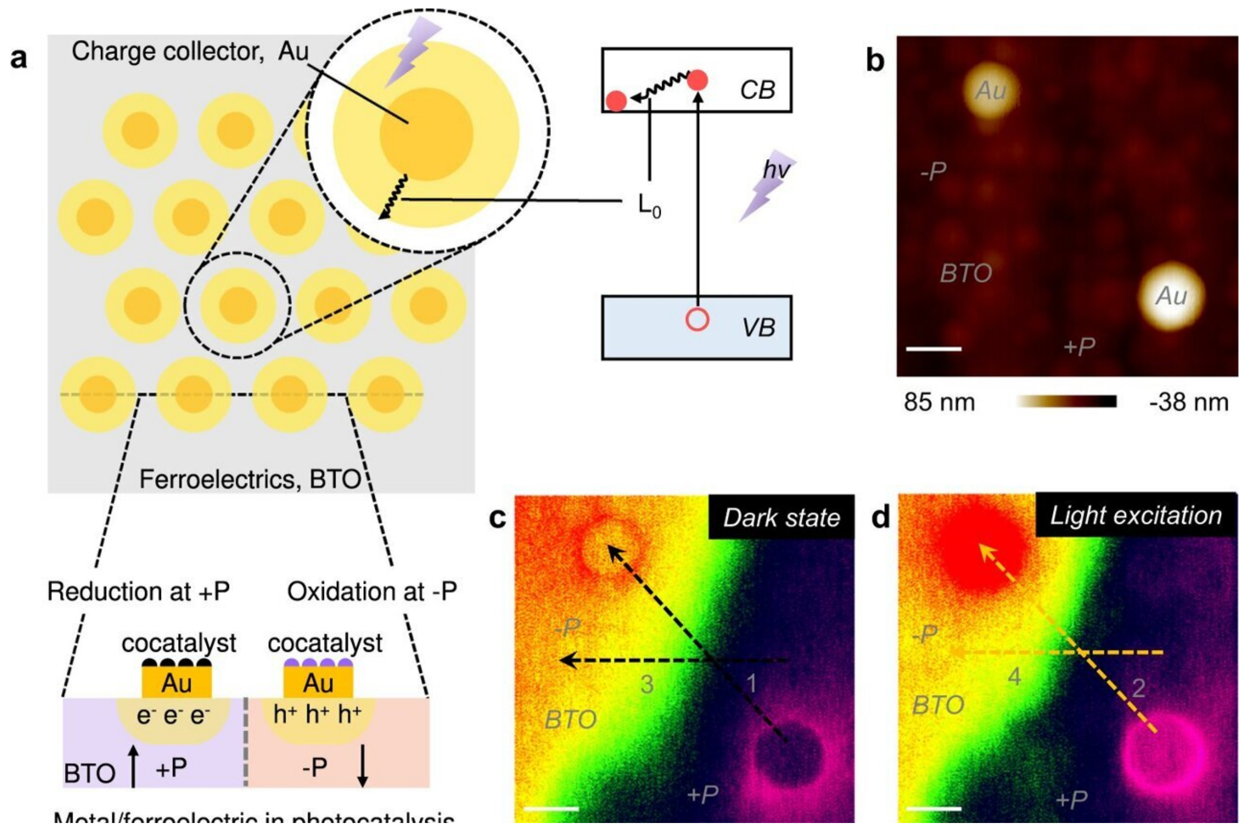
Scientists propose new charge separation strategy in ferroelectric photocatalysts

August 26 2022, by Li Yuan



Charge separation at meta/ferroelectric interface. a Schematic diagram of proposed metal/ferroelectric photocatalyst. b AFM topography of Au particles on a $BaTiO_3$ single crystal. Scale bar, 200 nm. c LWF of Au/BTO in the dark. Scale bar, 200 nm. d LWF of Au/BTO under 355 nm UV light (0.5 mW/cm^2). Scale bar, 200 nm. e Line 1 (dark) and 2 (UV light) profile images were taken across two antiparallel ferroelectric domains of BTO. f Line 3 (dark) and 4 (UV light) profile images were taken across two antiparallel ferroelectric domains of Au/BTO. Credit: *Nature Communications* (2022). DOI:

10.1038/s41467-022-32002-y

Ferroelectrics are photocatalytic candidates for solar fuel production. However, the performance of ferroelectric photocatalysts is often moderate and cannot achieve overall water splitting.

Recently, a research team led by Prof. Li Can and Prof. Fan Fengtao from the Dalian Institute of Chemical Physics (DICP) of the Chinese Academy of Sciences (CAS) has proposed a new charge separation strategy to fabricate interfacial charge-collecting nanostructures on positive and negative domains of ferroelectric, which enables water splitting in ferroelectric photocatalysts.

This study was published in *Nature Communications* on July 22.

The researchers chose the ferroelectric $BaTiO_3$ single domain crystal and Au nanoparticle as a model system to highlight the charge separation mechanism at Au/$BaTiO_3$ interface. They observed that photogenerated electrons and holes accumulated efficiently within their thermalization length (around 50 nm) around Au nanoparticles located in the positive and negative domains of a $BaTiO_3$ single crystal, respectively.

They found that the measured thermalization length was an essential experimental prescription for fabricating high-efficiency photocatalytic and photovoltaic devices on the nanoscale. With this structure design, constructed ferroelectric photocatalysts could perform photocatalytic overall water splitting.

"The fabrication of bipolar charge-collecting structures on ferroelectrics to achieve overall water splitting may set a paradigm for utilizing the energetic photogenerated charges in solar energy conversion," said Prof.

Fan.

More information: Yong Liu et al, Bipolar charge collecting structure enables overall water splitting on ferroelectric photocatalysts, *Nature Communications* (2022). DOI: 10.1038/s41467-022-32002-y

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