## Hole-Selective Electron-Blocking Copper Oxide Contact for Silicon Solar Cells (PV-3)

## Scientific Achievement:

A Cu<sub>2</sub>O/Si heterojunction fabricated at room temperature using a facile sputtering process was demonstrated to work as a holeselective contact for silicon solar cells. Passivating the Cu<sub>2</sub>O/Si interface leads to an open-circuit voltage (V<sub>oc</sub>) of 528 mV, which is 200 mV higher than the state-of-the-art.

## Significance and Impact:

Metal-oxide/silicon carrier-selective heterojunctions are attractive because oxides are stable, non-toxic, and can be deposited at low temperatures at potentially low cost. Defects at the oxide/Si interface have been known to be the factor limiting the efficiency of heterojunction silicon solar cells. This work demonstrates a Cu<sub>2</sub>O/Si hole-selective contact that shows one of the highest-reported values of V<sub>oc</sub> among cells without back-surface passivation.

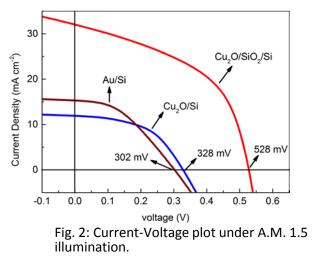
## **Research Details:**

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- Cu<sub>2</sub>O was deposited using reactive sputtering at room temperature.
- X-ray and ultraviolet (UV) photoelectron spectroscopy and UV-Visible spectroscopy were used to confirm the band-alignment between Cu<sub>2</sub>O and Si that matches for a hole-selective contact.
- The Cu<sub>2</sub>O/Si interface as deposited was found to have more than  $10^{12}$ /cm<sup>2</sup> • defects, which were passivated using a tunneling SiO<sub>2</sub> layer. This led to a  $V_{oc}$ of 528 mV, which is 200 mV higher than unpassivated devices.

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Dark current Fig. 1: Device structure and energy band diagram for a hole-selective contact.



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