Advancing silicon thermophotovoltaics by scaling air-bridge technology

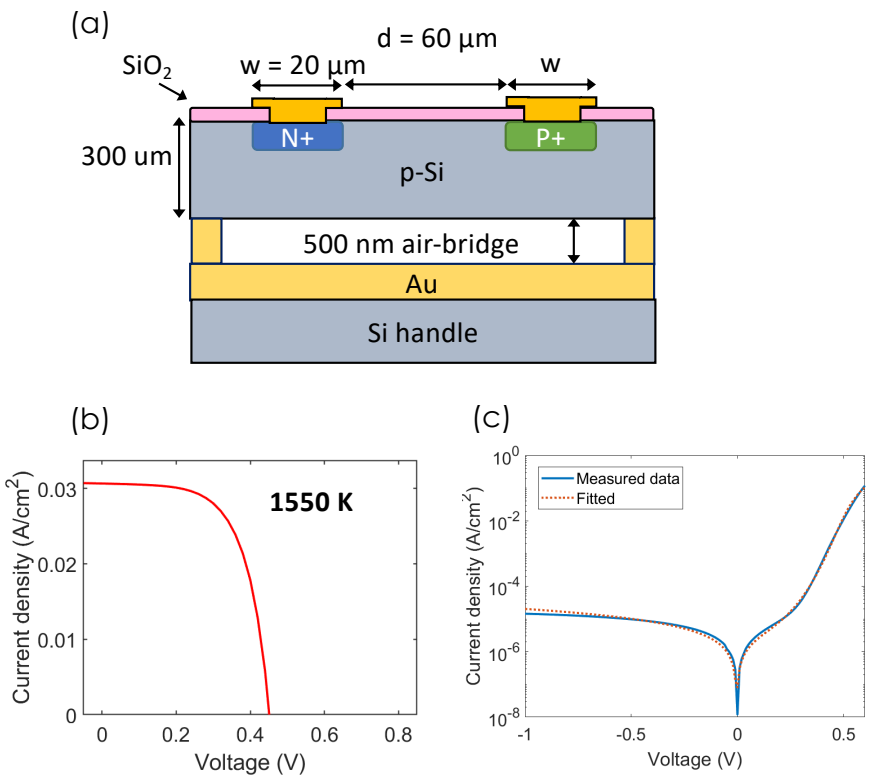

Figure: (a) Schematic of the horizontal view of the interdigitated top contact lateral p-n junction Si TPV cell with air-bridge back-surface reflector (b) Current density vs voltage plot for an illuminated single air-bridge Si TPV cell at 1550 K (c) Current density vs voltage plot for the air-bridge Si TPV cell under dark

Objective

➢ To develop high efficiency, large-area silicon thermophotovoltaic modules utilizing the air-bridge technology to drive real-world applications

Impact

High efficiency silicon TPV cells can be used for cost-effective, clean energy generation by converting high temperature thermal emission to electrical energy. Our group has previously demonstrated high PCE (19% at 1988K) lateral p-n junction Si TPV cells employing the air-bridge back surface reflector (BSR) which enables significantly higher out-of-band reflectance (~98%) compared to conventional Au BSR (~95.3%). In this work, we aim to integrate the air-bridge Si TPV cells into large-area modules to generate enough electrical power to drive real-world circuits. This work would establish the viability of the air-bridge technology for commercialization of high efficiency silicon TPV cells.

Facilities and Methods Used

- High-temperature silicon processing furnaces
- Photolithography
- Chemical vapor deposition
- Cold-weld bonding
- Thermal evaporation

Funding

- US Space Force
- GHOVentures
- US Army Research Office, MURI

Collaborators

- Group of Prof. Andrej Lenert

Contact

- Trystan Elliot (udonbowl@umich.edu)

Optoelectronic Components and Materials Group OCM