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Sandia Academic Alliance Spring UT Austin Research Poster Session | Sandia Day 2022

222374 / Dual-band Angle Dependent MWIR Absorber

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Introduction / Motivation

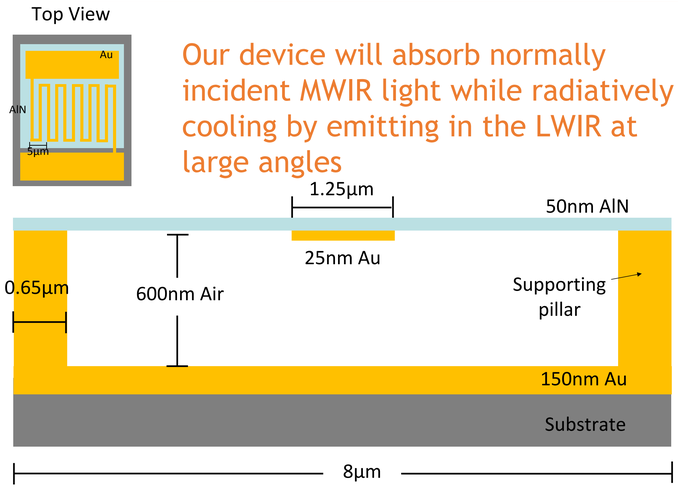
Objects much hotter than 300K can emit thermal radiation in the mid-wave infrared (MWIR, $\lambda = 3 - 5\mu m$) and can require fast response times to image effectively.

Issue: how to cool a MWIR bolometer?

- Fast response times require fast dissipation of thermal load
- Radiative cooling of room temp objects occurs primarily in the long-wave IR (LWIR)

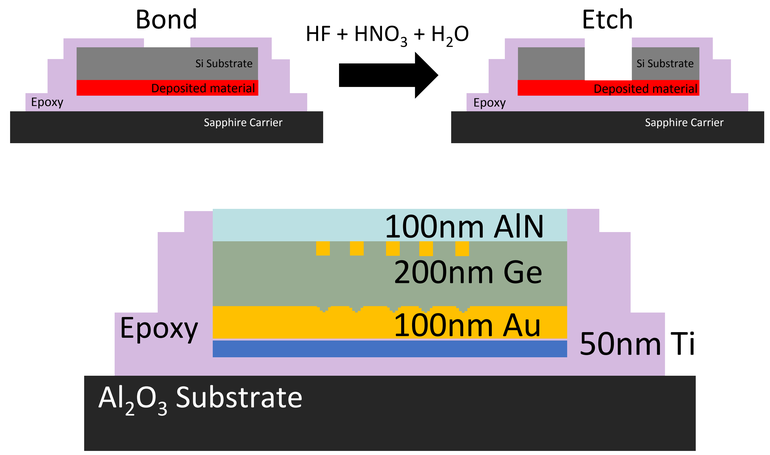
We are creating light absorbing elements for micro-bolometer arrays that display strong, angle dependent absorption and emission in the MWIR and LWIR, respectively.

Approach



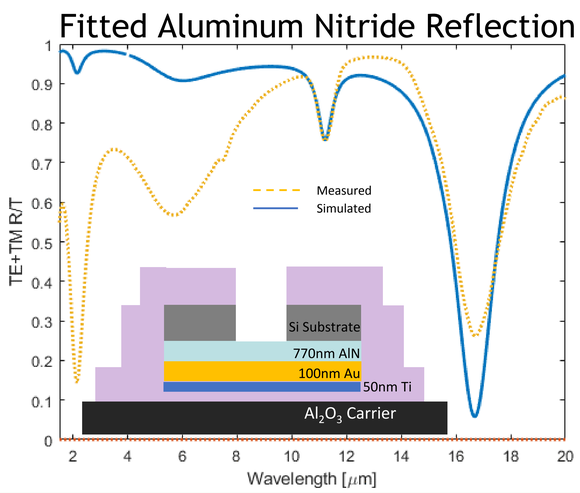
Our device will absorb normally incident MWIR light while radiatively cooling by emitting in the LWIR at large angles

Cross section of a unit cell of the version of device that incorporates an air gap to facilitate radiative cooling

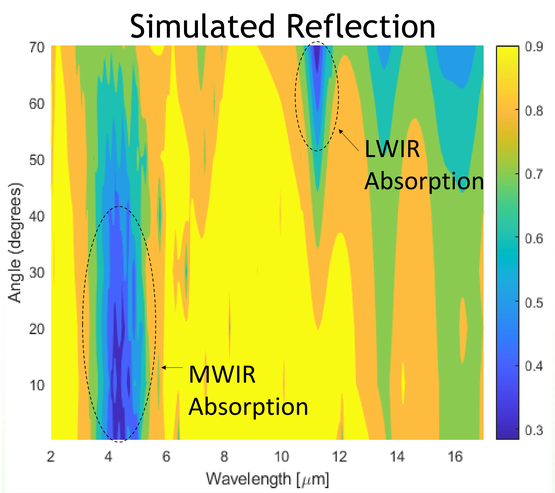


Cross section of germanium-supported proof of concept structure

Current Status / Results



Measured and simulated reflection spectrum of an aluminum nitride and gold dummy sample



Simulated Reflection of the germanium supported structure

Challenges

- Limited supply of sufficient quality aluminum nitride
- Removal of the sacrificial substrate results in relaxation of the aluminum nitride layer
  - Dummy etch has the desired absorption features
  - Effect on deposited antennae is unknown
- Our wet etch is not selective against germanium; it requires in-stack and sidewall protection to prevent etching

Next Steps / Future Work

- Complete fabrication of germanium supported structure
- Characterize proof of concept structure and demonstrate dual-band, angle dependent absorption
- Modify the structures as needed to achieve the preferred optical behavior
- Fabricate and characterize the air cavity structure

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