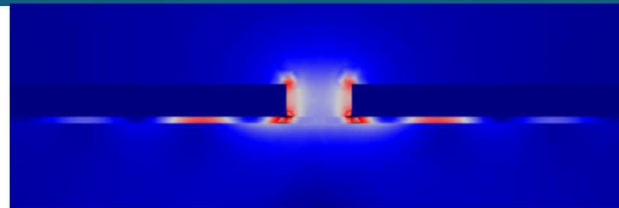
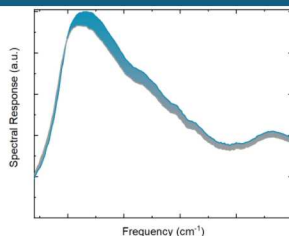
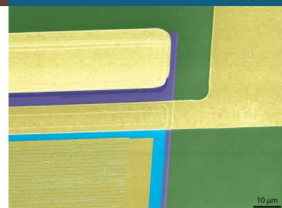
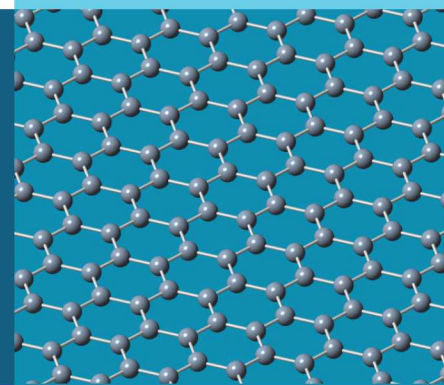




SAND2018-13392C

Low-Voltage LWIR Tunable Transmission Filters Leveraging Graphene Plasmons



Thomas Beechem

Team

M. Goldflam, I. Ruiz, S. Howell, M. Sinclair, A. Tauke-Pedretti, J. Wendt, E. Anderson, W. Coon, T. Fortune, S. Hawkins, P. Finnegan, C. Kadlec, P. Webster, E. Shaner, J. Klem, J. Kim, D. Peters



Sandia National Laboratories is a multimission laboratory managed and operated by National Technology & Engineering Solutions of Sandia, LLC, a wholly owned subsidiary of Honeywell International Inc., for the U.S. Department of Energy's National Nuclear Security Administration under contract DE-NA0003525.

Vision: Dynamic Multi-Functional IR Sensing



Imagine



Right Now



Problems:

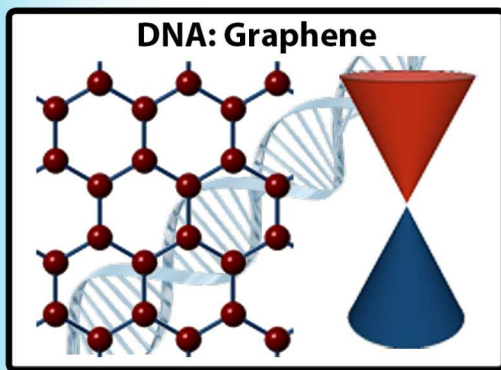
1. One color for whole array
2. Moving Parts

Approach: Integrated Graphene Infrared Filters



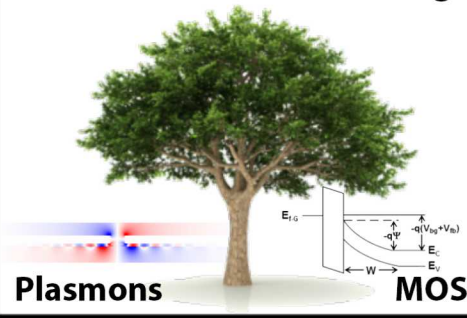
Goal: Spectrally tunable filters at single pixel level

Premise



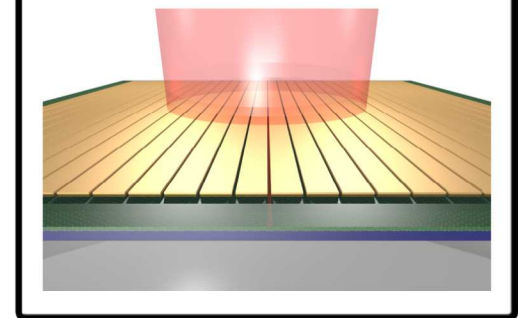
+

Environment & Surroundings



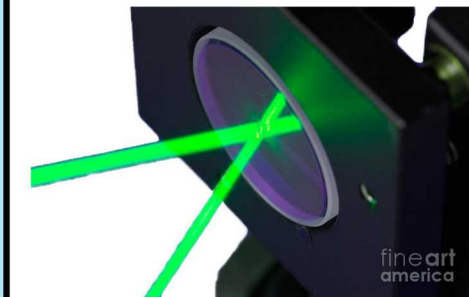
=

Tunable IR Filters



Path

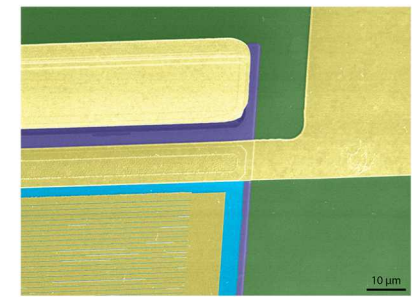
Reflection



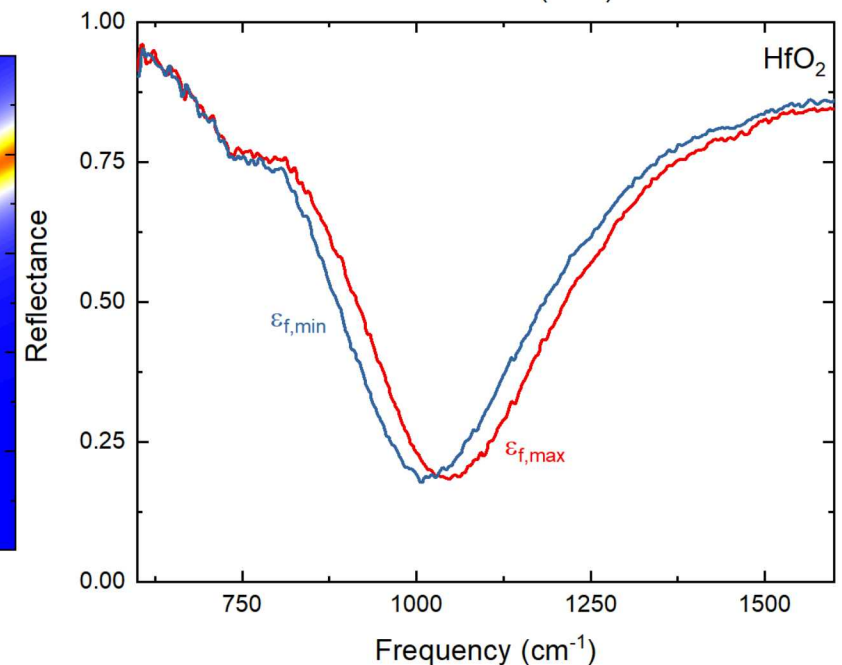
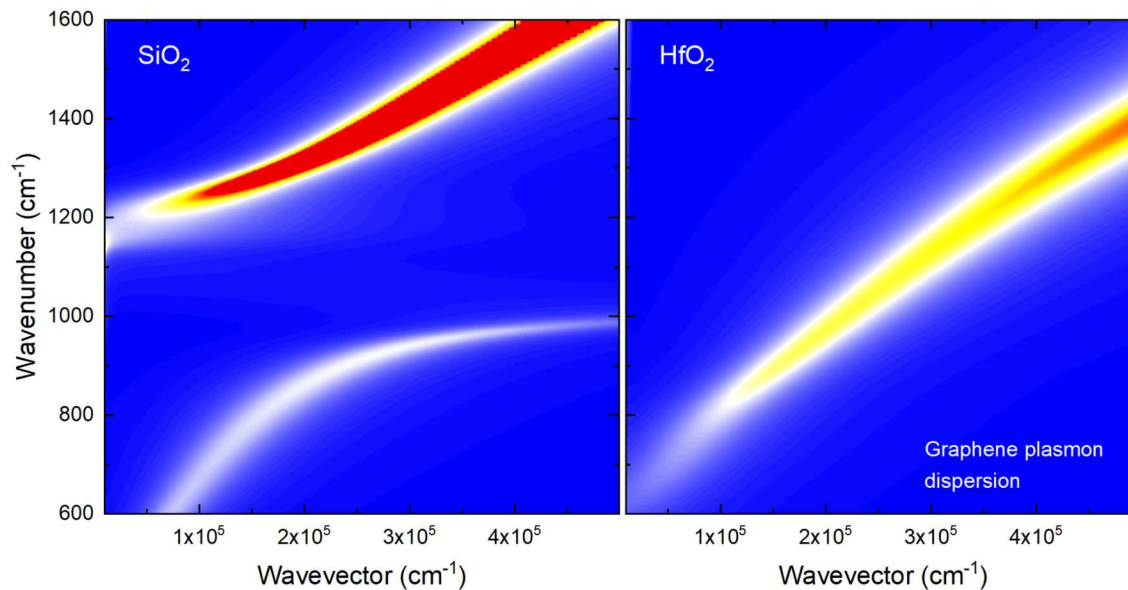
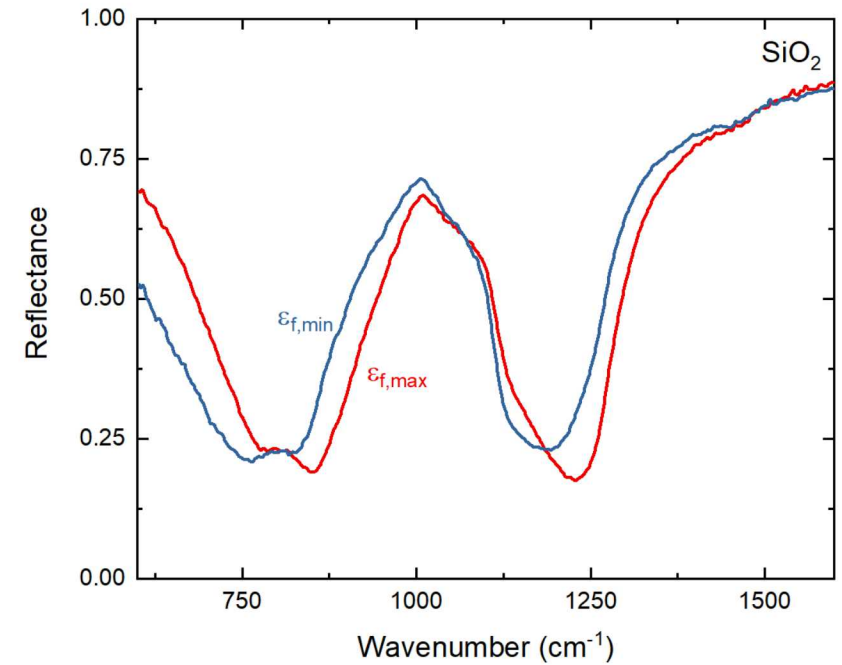
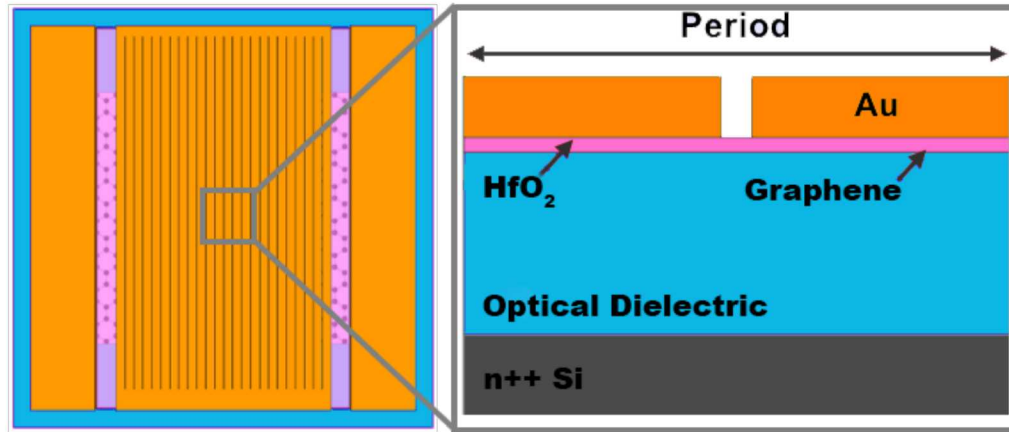
Transmission



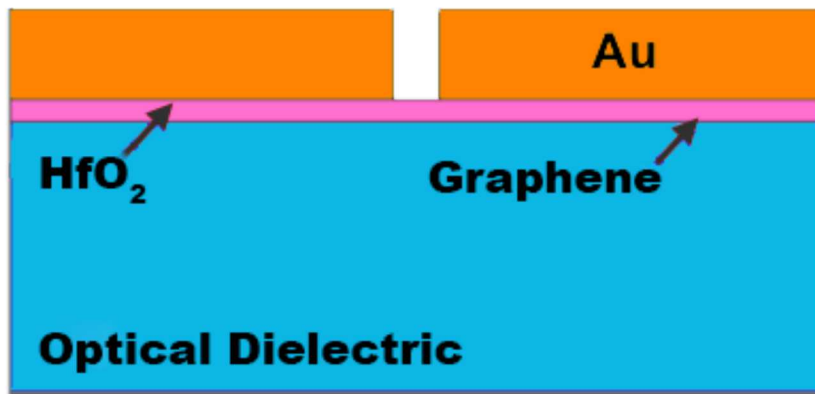
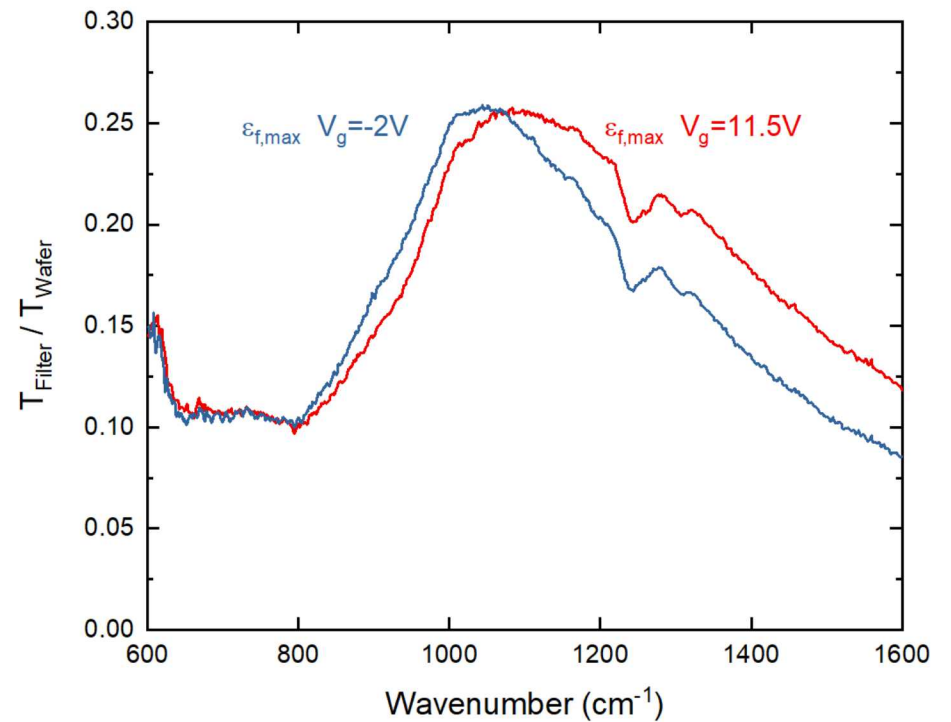
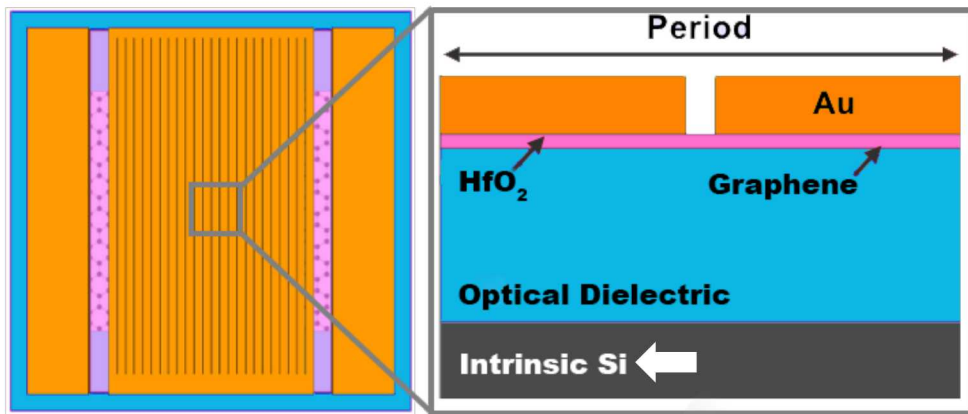
Integration



Reflection: Leveraging Dielectrics



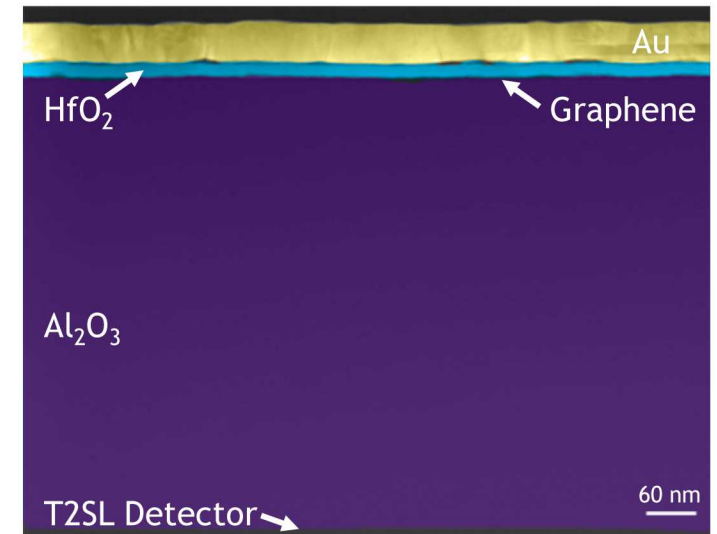
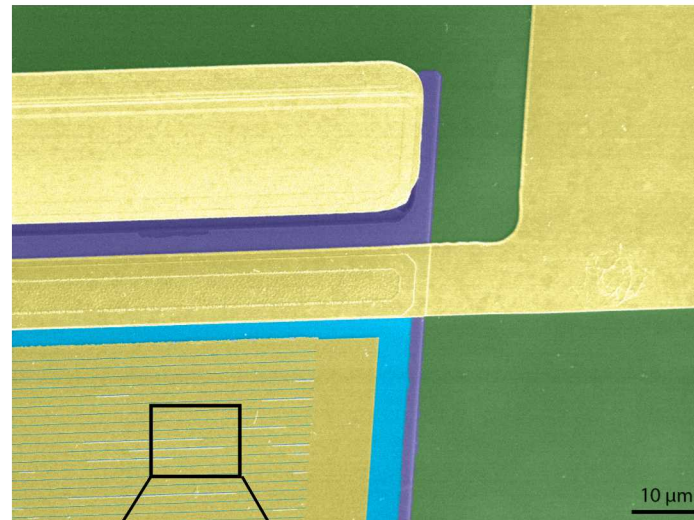
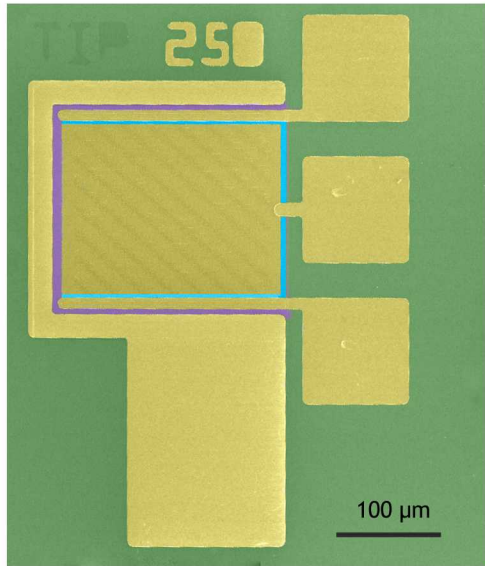
Transmission: Low-Voltage Tuning



Can we build it directly on detector?



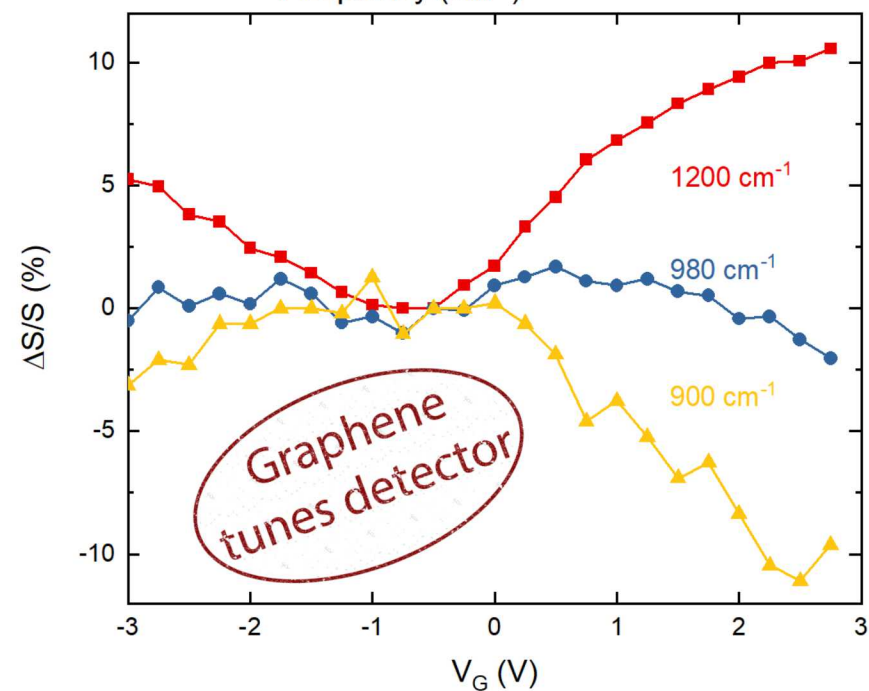
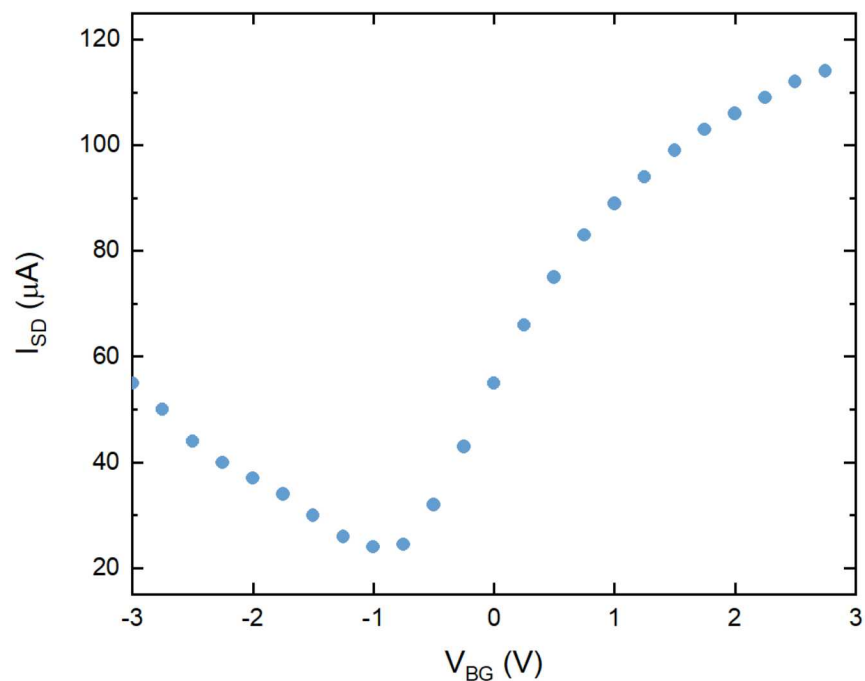
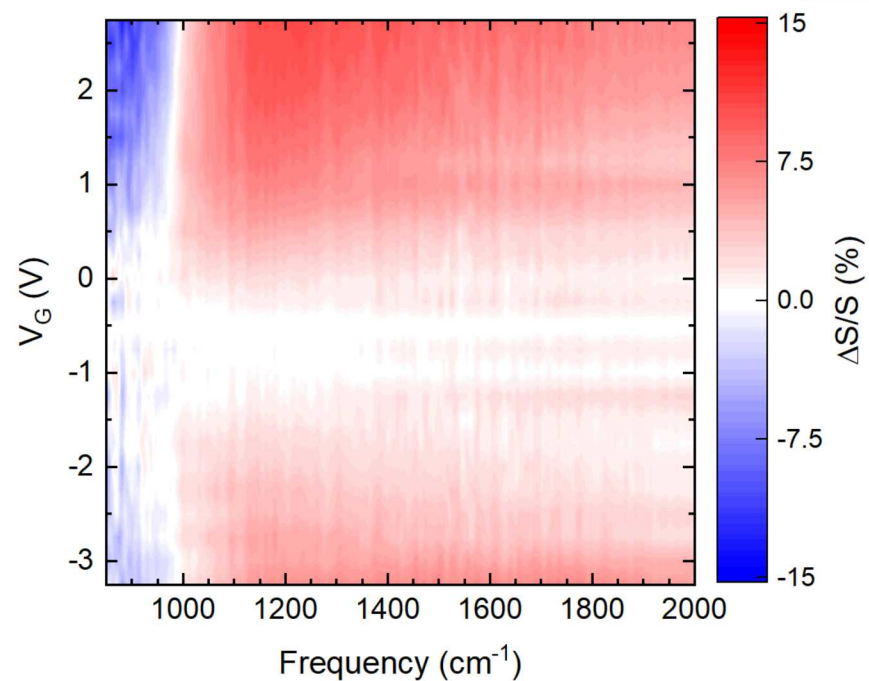
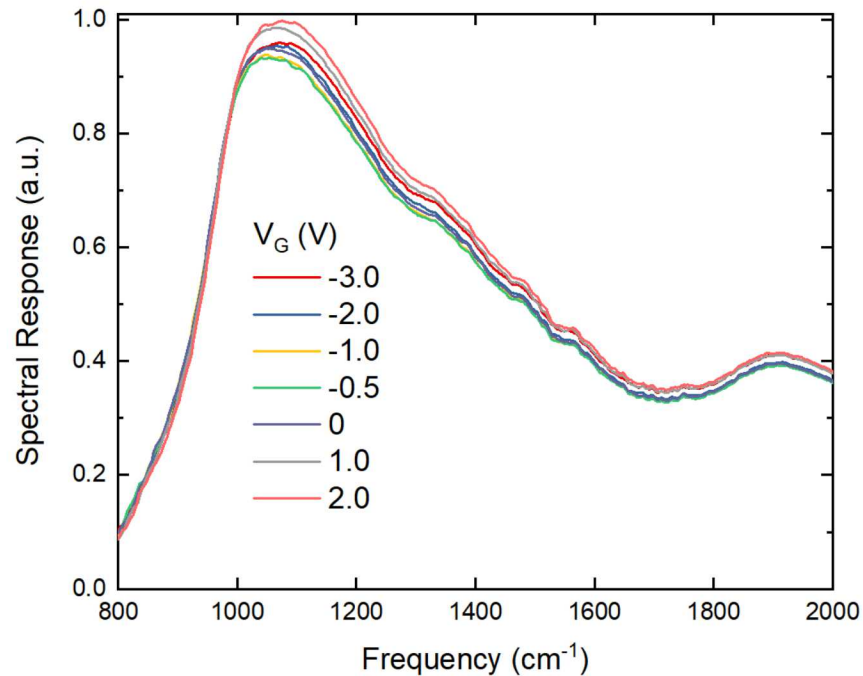
Goal: Detector and tunable filter all in one



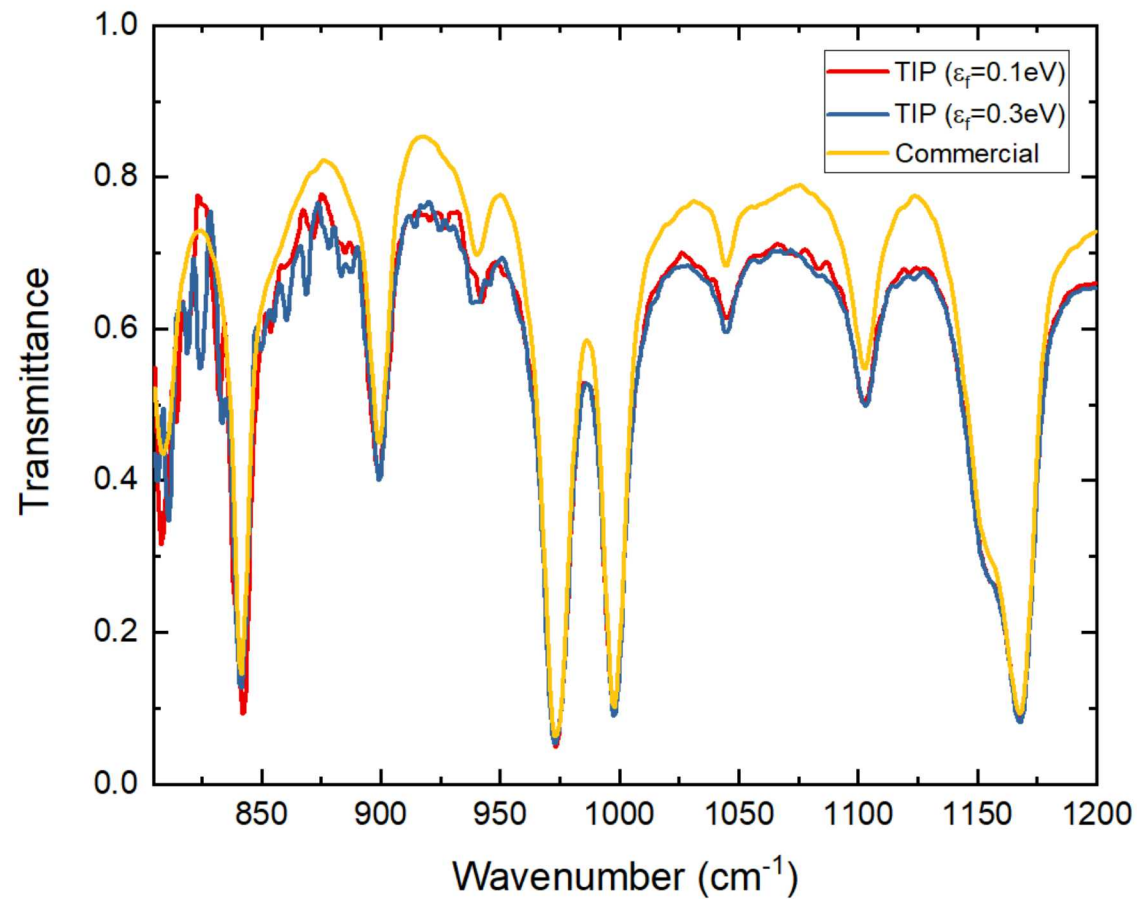
No Moving
Parts

Intrinsic
Alignment

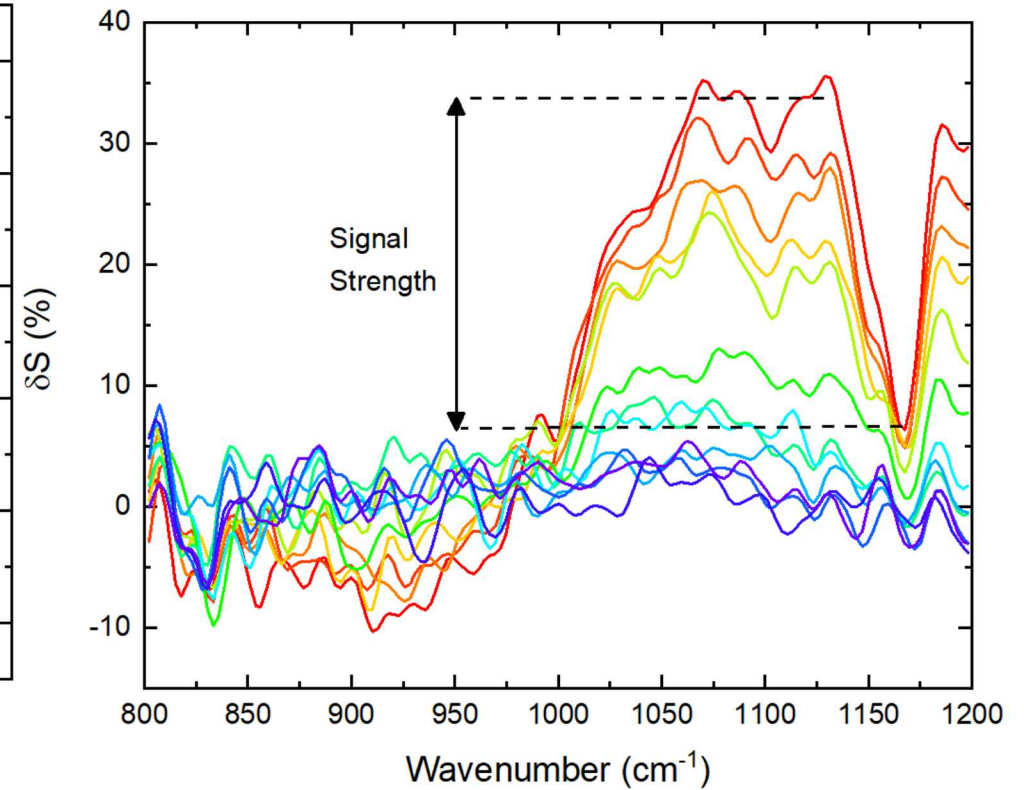
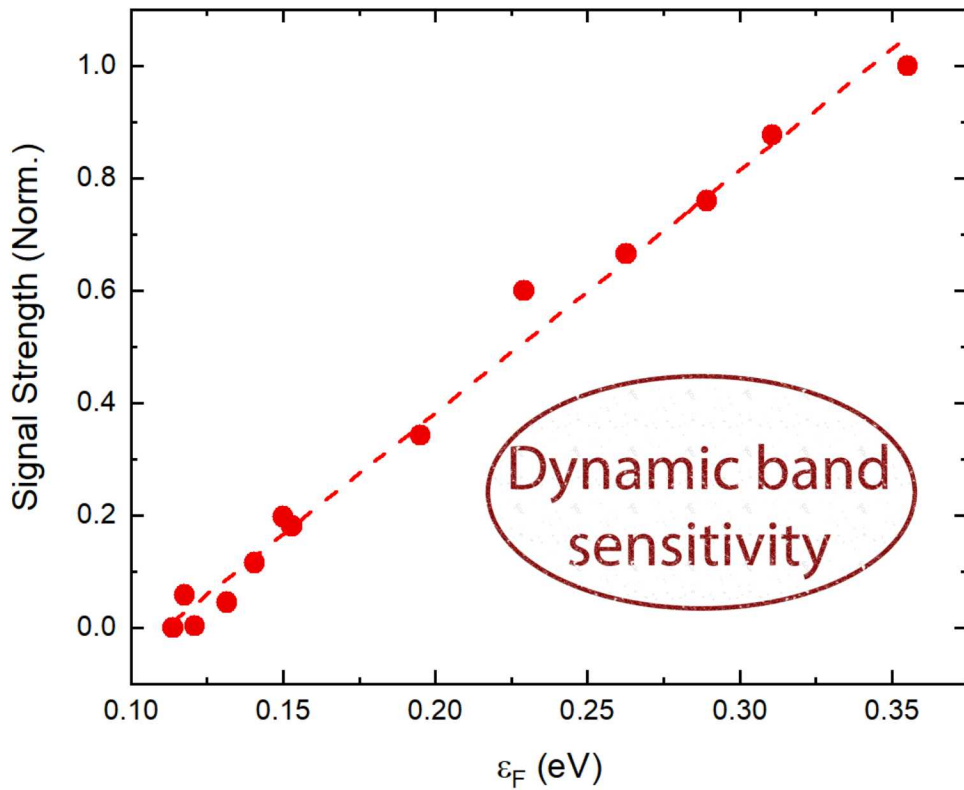
Standard Fab
Processing



Game: Use TIP to measure polymer transmission



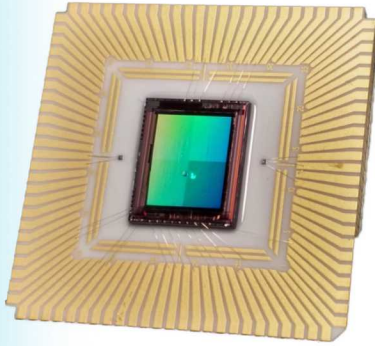
Game: Use TIP to measure polymer transmission



Take Home Message



Vision



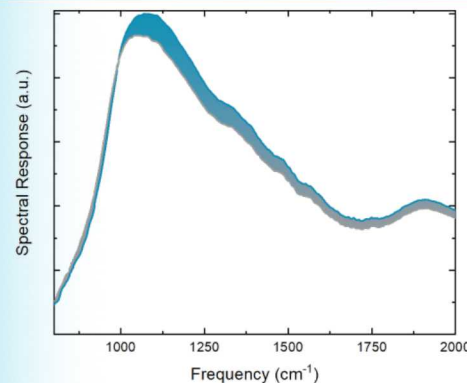
Dynamic, tunable, infrared sensing at pixel level

Path



Encased graphene alloys integration directly atop detector

Outcome



Fully integrated spectral tunability at single pixel level