Composite Reflective/Absorptive IR-Blocking Filters on Metamaterial Anti-reflection Coated Silicon

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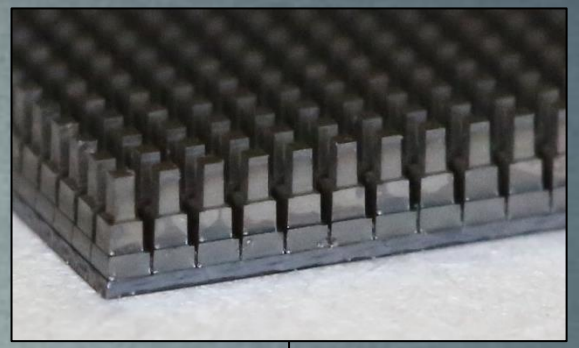
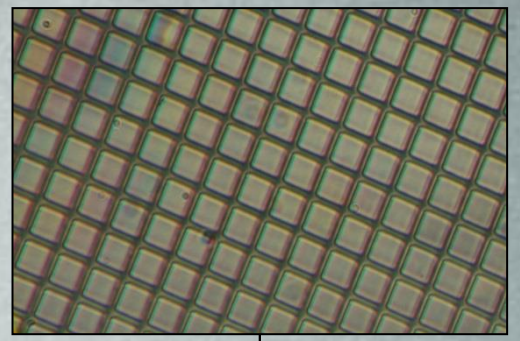
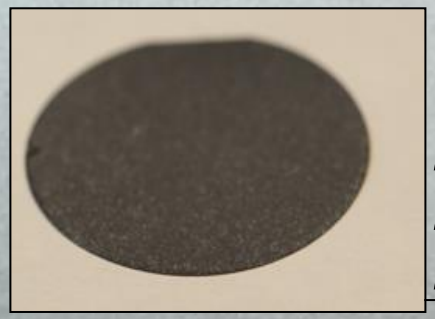
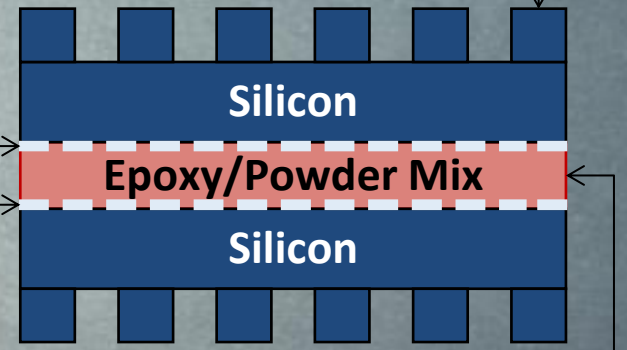
Anatomy of Our Composite Filter

1. Metamaterial AR coated Silicon
   - Demonstrated >3:1 bandwidth on optics >30cm diameter
2. Patterned reflective frequency selective surfaces
   - Reflects ~90% of 300K blackbody
3. Scattering and absorptive optical epoxy & Reststrahlen powder composite (Yamada powder filters)
   - Absorbs/scatters >90% for a 25um layer









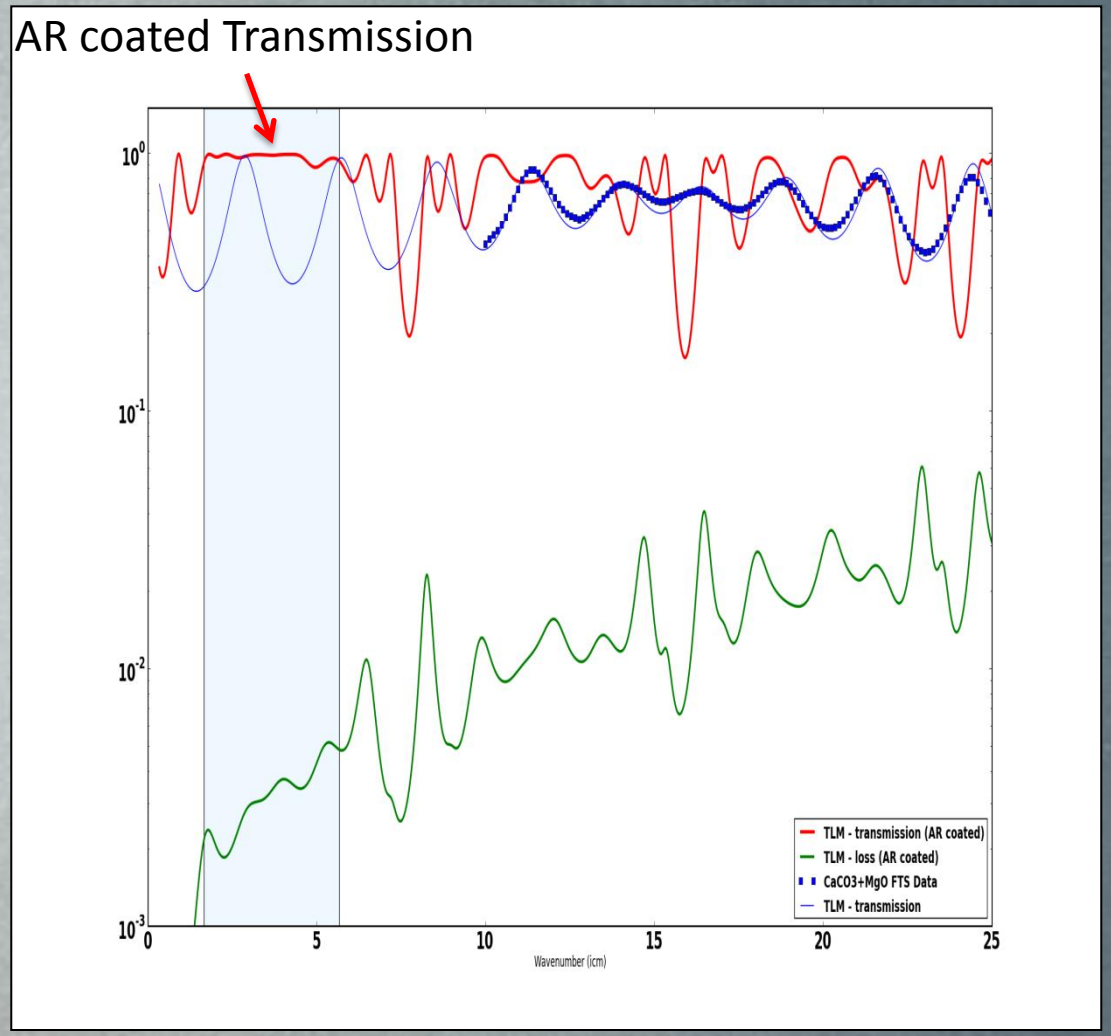
AR Coated Silicon

Reflective Metal Mesh

Epoxy and Reststrahlen Powder Mix

Low Frequency Performance

- FTS measurement down to 10 icm.
- Fit with transmission line model, extrapolate to lower frequency
- Include realistic AR coating for ~50-170 GHz transmission band
  - >99% transmission in band



IR Blocking Performance

- FTS measurements of 1” diameter samples fabricated on high resistivity Si
- Measured from 30-5000 icm
- Composite filter shows excellent blocking (>98% of 300K blackbody, measurement limited), with minimal heating