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Broadband Metamaterials for Shielding Against DEW

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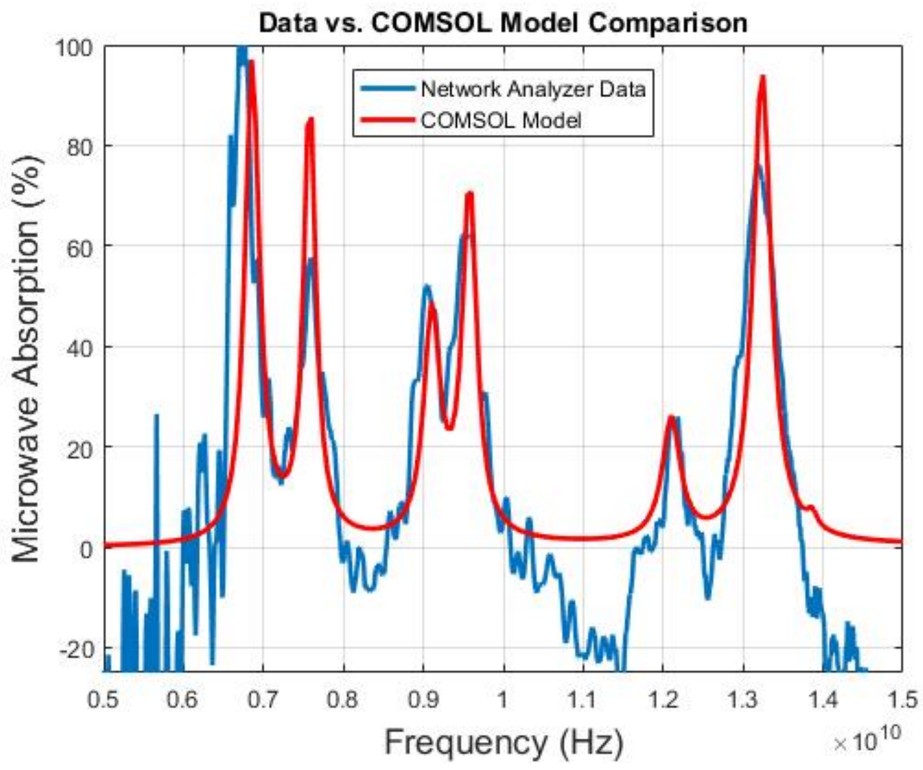
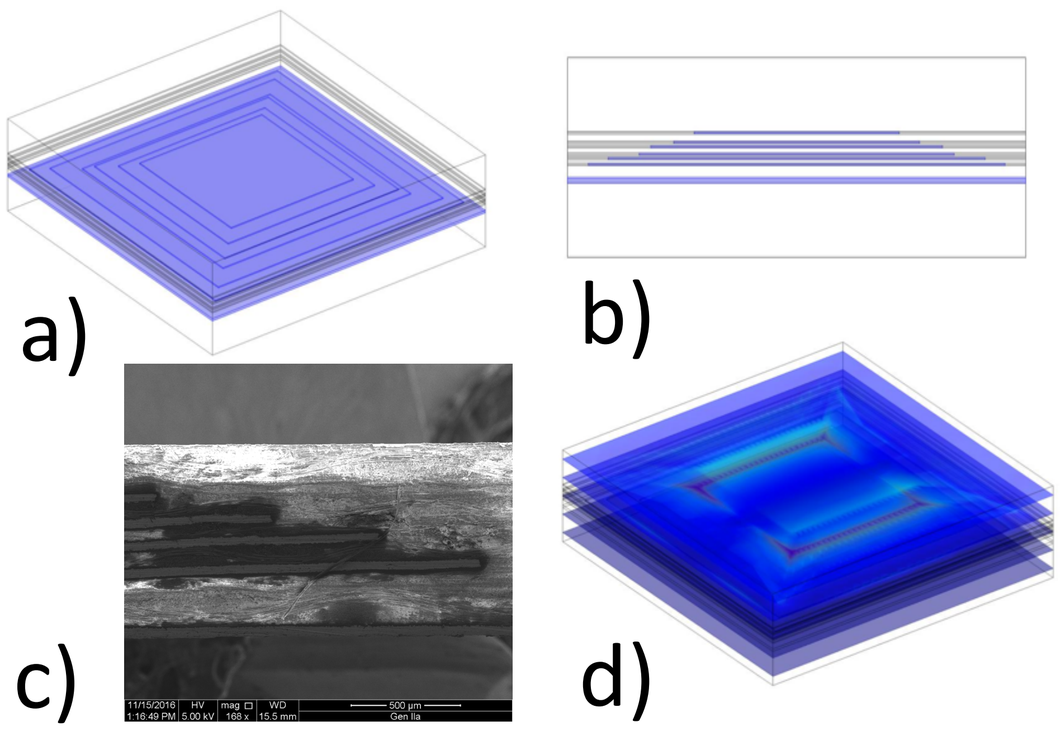
Summary

This project accomplished building and testing several generations of broadband metamaterials. These are the materials with tailored optical properties, not found in any naturally occurring materials. The goal of this project was to test the viability of designing building broadband metamaterials that could serve as a shield against microwave directed energy attack.
Keywords: *metamaterials, microwave, directed energy weapon (DEW)s, shielding, counter-directed energy weapons (CDEW)*



Absorption spectrum of the broadband metamaterial



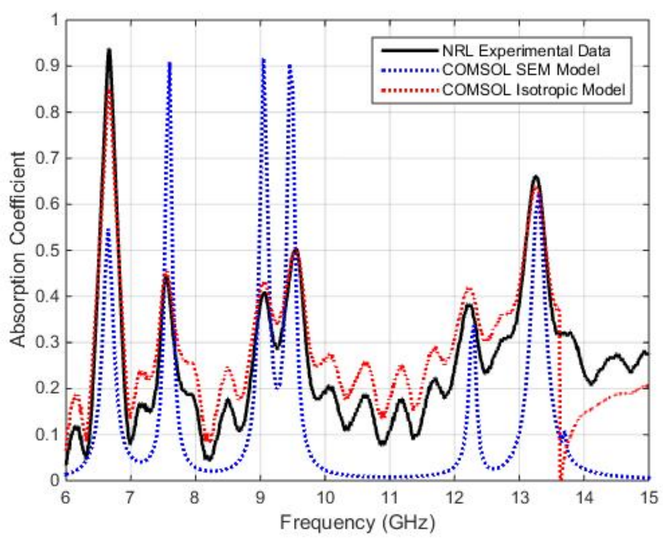
a) Unit cell of a broadband metamaterial, b) side view, c) SEM micrograph of side view and d) using finite element model to quantify localized parameters such as the magnitude of the electric field within metamaterial

Accomplishments

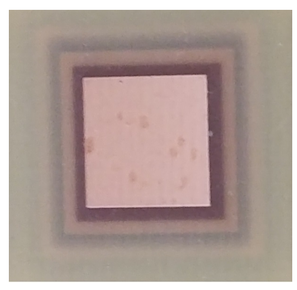
- 2 generations of rigid, broadband metamaterials
- 1 generation of flexible, narrowband metamaterials
- Developed and refined a finite element model in good agreement with the experimental measurements
- Framework for replacing complex metamaterials with simpler, homogeneous elements

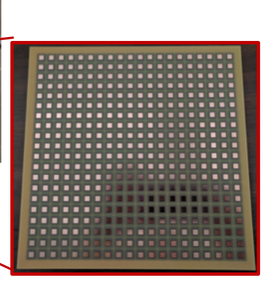
Conclusions

- It is possible to design and build metamaterials absorbent over a broad band of electromagnetic spectrum
- Using the finite element model, it is possible to design and tailor the spectral response.
- Higher energy sources needed to test performance at realistic intensities of incoming radiation.



Experimental setup





Future work

- Design metamaterial with absorption peaks closer together
- Model larger geometries using the homogeneous material framework
- Build and test broadband metamaterial with sensing capabilities
- Partner with NSWC Dahlgren to expose these metamaterials to higher intensity radiation
- Verify that the model accuracy at higher energies.

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