Radar Cross Section measurements on the stealth metamaterial objects

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Absorbing metamaterials (MM) offer the exciting possibility of near-unity absorption at specific resonance frequencies where the characteristic impedance $Z(\omega)$ is designed to match the free-space impedance and the imaginary part of the refractive index $\kappa(\omega)$ is as high as possible. Such materials have been realized in the form of thin, flexible metallized films of polyimide [1]. Here we apply a near-unity absorbing MM as a way to reduce the radar cross section of an object, and consider the real-life situation where the probe beam is significantly larger than the MM film and the object under investigation. We use a terahertz radar cross section (RCS) setup [2] for the characterization of the RCS of a real object covered with an absorbing MM film designed for high absorption in the THz frequency range, specifically at 0.8 THz. The results are in a form of 2D maps (sinograms), from which the RCS is calculated for specific frequencies within the bandwidth of the THz signal. We observe a significant reduction of the RCS at the resonance frequency of the MM absorber (0.82 THz) compared to the off-resonance RCS (here 0.4 THz).

[1] H. Tao *et al.*, Phys. Rev. B. **78,** 241103(R) (2008)

[2] K. Iwaszczuk *et al.*, Opt. Exp. **18,** 26399 (2010)