Highlights

Fundamental properties - 2016

Waveguide Characterisation of S-Band Micowave Mantle Cloaks for Dielectric and Conducting Objects

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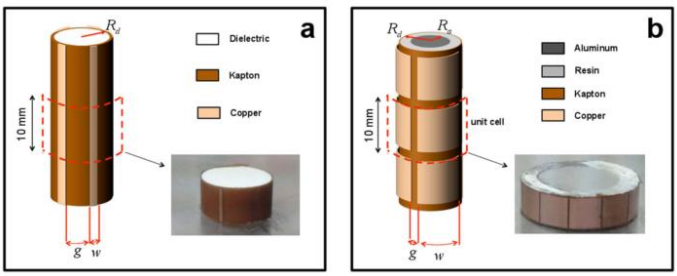
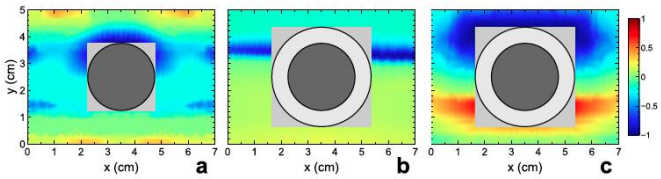
We present the experimental characterization of mantle cloaks designed so as to minimize the e.m. scattering of moderately-sized dielectric and conducting cylinders at S-band microwave frequencies. The experimental setup is based on a parallel-plate waveguide system, which emulates a two-dimensional plane-wave scattering scenario, and allows the collection of near-field maps as well as global scattering observables. Our results provide an illustration of the mantle-cloak mechanism and confirm its effectiveness both in restoring the near-field impinging wavefront around the scatterer, and in significantly reducing the overall scattering

Cloaking using metasurfaces:



(a) Dielectric cylinder of radius Rd = 10mm covered by a metasurface made of metallic(copper) strips substrate. Also shown is a photo of the fabricated prototype of finite (10mm) thickness.
(b) Conducting (aluminium) cylinder covered by a metasurface made of metallic (copper) conformal square patches

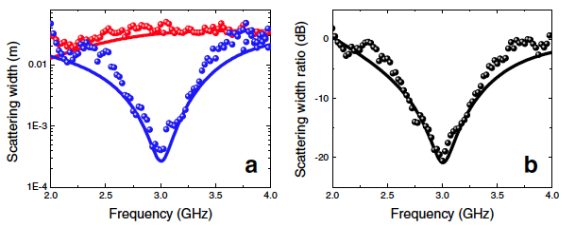
Measured (real-part) electric-field maps for the conducting cylinder:



(a) Uncloaked cylinder at the nominal design frequency 3 GHz. (b), (c) Cloaked cylinder at 3 GHz and outside the cloaking band (4 GHz)), respectively.

Reduction of the scattering cross section SW @ 3 GHz:

$$SW = \frac{\oint_C \mathrm{Re}[E_z^{sc}\hat{z} \times (\mathbf{H}^{sc})^*] \cdot \hat{\mathbf{n}} d\ell}{\eta_0 |E_z^{in}|^2}$$



(a) SW in semilog scale as a function of frequency for the dielectric cylinder in the absence (red markers) and presence (blue markers) of the mantle cloak.
(b) Corresponding SW ratio in dB scale (black markers).