Gold cone metasurface MIC sensor with monolayer of graphene and multilayer of graphite

ABSTRACT

This report makes a comparison between the spectrum features of plasmonic metamaterial metal-insulator-conductor (MIC) sensor with a monolayer of graphene and another MIC sensor with a multilayer of graphite as the back reflector. In both structures, the silicon substrate as an insulator layer was sandwiched between subwavelength periodic nanogold cones as the first layer and graphene and graphite as the third layer, respectively. Nanolayer of chromium nanorods was also considered in the structure of MIC sensors as an interface layer between silicon and nanogold cone metasurface. The performance of the sensor was evaluated under different incident polarized light angles and different thickness of the metasurface when the metasurface infiltrated with seawater and air. The transmission spectrum of monolayer graphene-based MIC sensor, respecting to s-polarized waves, reveals prominent feature to detect the air rather than seawater in invisible regime. Meanwhile, the reflection spectrum of graphite-based MIC sensor provides ~0 % reflection under resonance condition regarding s- and p-polarized waves for detecting air in visible spectrum.

Keyword: Metamaterial MIC sensor; Plasmonic; Graphene; Graphite; Nanogold cone