Graphene-enabled electrically switchable radar absorbing surfaces

Osman Balci, Emre O. Polat, Nurbek Kakenov, Coskun Kocabas.

Bilkent University, Department of Physics, Ankara, Turkey
obalci@fen.bilkent.edu.tr

Abstract

Radar absorbing materials are used in stealth technologies for concealment of an object from radar detection. Resistive and/or magnetic composite materials are used to reduce the backscattered microwave signals[1,2]. Inability to control electrical properties of these materials however, hinders the realization of active camouflage systems which require adaptive surfaces operating in microwave frequencies[3-5]. Here, using large-area graphene electrodes, we demonstrate a new class of active surfaces which enables unprecedented ability to control reflection, transmission and absorption of microwaves by electrical means. Instead of tuning bulk material property, our strategy relies on electrostatic tuning of the charge density on an atomically thin electrode which operates as a tunable metal in microwave frequencies. Notably, we fabricated large area adaptive radar absorbing surfaces with tunable reflection suppression ratio up to 50 dB with operation voltages less than 5 V. To demonstrate the promises of our method we fabricated various device architectures including pixelated and curved surfaces. These electrically switchable radar absorbing surfaces provide a significant step in realization of active camouflage systems and adaptive cloaking in microwave frequencies, which cannot be realized by conventional materials.

References

[1] Feng, Y. B., Qiu, T., Shen, C. Y. & Li, X. Y. *Ieee T Magn* **42**, (2006) 363-368.
[2] Pitman, K. C., Lindley, M. W., Simkin, D. & Cooper, J. F. *Iee Proc-F* **138**, (1991) 223-228.
[3] Ford, K. L. & Chambers, B. *Electron Lett* **36**, (2000) 50-52.
[4] Neelakanta, P. S., Stampalia, A. K. & De Groff, D. *Microwave J* **46**, (2003) 22-+.
[5] Chambers, B. *Smart Mater Struct* **8**, (1999) 64-72.

Figure

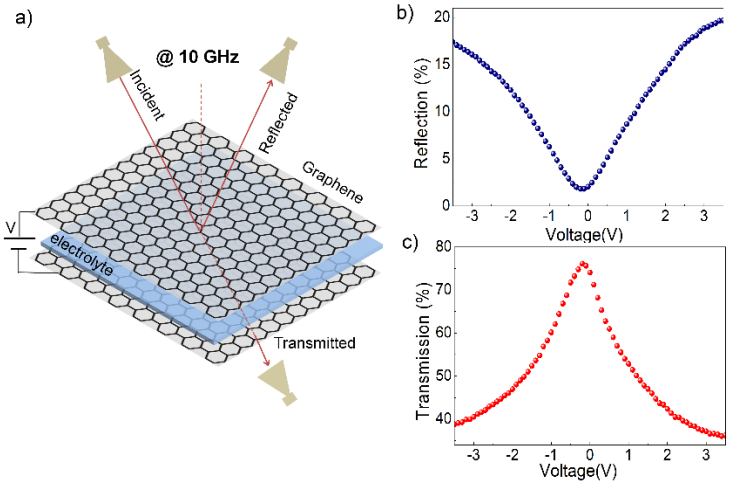

Figure : a)Experimental setup used for microwave measurements. A microwave transmitter at 10.5GHz and two receivers were used. b,c) Measured intensity of the reflected and transmitted microwaves plotted against the bias voltage.