Graphene-based ultra-wide band printed antenna

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Abstract

The widespread of wireless smart tagging in consumer products and packaging is creating a growing demand for cheap and easy to implement radio frequency identification (RFID) antennas. The annual market value of RFIDs is estimated to reach billion dollars value within the next ten years[1]. Cost is currently considered the main limiting factor for the diffusion of RFID tagging in packaging and logistics with a target of less than 5 cents for RFID tag [2,3]. Metal ink-based printed antennas currently represent the cheapest alternative to evaporated metal ones [4]. Unfortunately, copper- and nickel-based inks present serious oxidation issues, while silver ink is expensive. Graphene is emerging as a valuable alternative to the current metal-based technology [5,6]. In fact, the possibility to process graphene in liquid and formulate functional inks [7] is opening huge opportunity in the printed electronic field [8]. Herein, we present a hybrid graphene/silver ink antenna printed on cardboard suitable for the use in the UHB RFID frequency range [9]. A few layer graphene (FLG) powder, obtained by a wet-jet milling process [10], is dispersed in an ethanol-water solution and mixed with a commercial water-based binder and a small percentage of silver ink (silver/FLG ratio <0.1). The antenna is then stencil printed on cardboard at room temperature. Our graphene-on-cardboard antennas show ultra-wide band (UWB) response at ~2.5 GHz with a fractional bandwidth close to 0.5 and an efficiency of ~30%. Its UWB response makes it ideal for low cost printed RF applications, including RFIDs, smart sensors and short range high speed data transfer.

References

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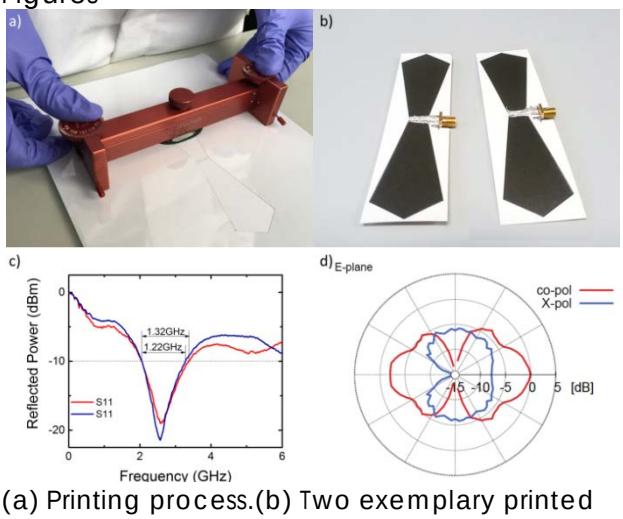
Figures



(a) Printing process.(b) Two exemplary printed antennas. (c) Reflected power (S_{11}) of the graphene antennas printed on cardboard. (d) Polar plot of the printed antenna emission on the E-plane.