On the Use of 3D Printable Conductive Materials for Antenna Fabrication

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In the past few years, using Additive Manufacturing (AM) technology for the fabrication of the Radio Frequency (RF) products has increasingly been growing in industry and academia. Three dimensional (3D) priming technology using layer based AM has found a lot of applications in the fabrication of antennas. In most of the studies, the dielectric part of the antenna is fabricated using 3D printing technology and the conductive part is added using other methods such as coating or direct printing of conductive inks. For example in a study (A. Garcia Lopez, E. E. Lopez C., R. Chandra, and A. J. Johansson, *7th EuCAP*, 2013, pp. 1471-1473) 3D printed volcano smoke antenna was fabricated using this method. In another study (M. Ahmadloo and P. Mousavi, *IEEE Int. Symp. On Antennas and Propag., 2013*, pp. 780-781) combination of conductive nanoparticle ink and 3D printing of dielectric material was presented as one integrated process for fabrication of conical antennas. The capability of Aerosol Jet technology to print conformal electronics on 3D structures has been demonstrated in (J. A. Paulsen, M. Renn, K. Christenson, and R. Plourde, *Future of Instrumentation International Workshop (FIIW), 2012*, pp. 1-4.).

Recently novel conductive materials have been introduced to the market. These materials are suitable for 3D printing of conductive parts of the antennas, simultaneously with the dielectric parts. For example Proto-pasta™ conductive PLA is a great choice for low-voltage circuitry applications, touch sensor projects, and using prints to interact with touch screens (https://www.proto-pasta.com/pages/conductive-pla). Functionalize F-Electric™ has introduced another product as highly conductive PLA with volume resistivity of 0.75 Ω.cm (http://functionalize.com/about/functionalize-f-electric-highly-conductive-filament/). This paper studies different conductive materials for 3D printed antenna applications. Figure 1 shows an example of a dipole antenna printed using Functionalize F-Electric™ highly conductive PLA.

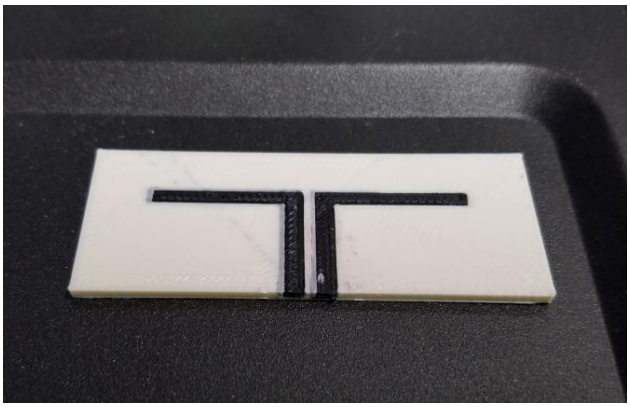

Figure 1. 3D printed antenna using Functionalize F-Electric™ highly conductive PLA.