

# Graphene Antenna for Mobile Phone Application

Rongguo Song, Chunyu Liu, Ning Zhang, Jingwei Zhang, Chengguo Liu, Daping He\* and Zhi Wu\*  
Hubei Engineering Research Center of RF-Microwave Technology and Application  
Wuhan University of Technology, Wuhan, China  
hedaping@whut.edu.cn, z.p.wu@whut.edu.cn

**Abstract**—This paper presents three graphene film based antennas (main antenna, WIFI antenna and Bluetooth antenna) for mobile phone application. The conductivity of the graphene film is  $5 \times 10^6$  S/m, which is comparable to copper ( $1.35 \times 10^7$  S/m). As a result, the mobile phone with Graphene antenna phone has the same function as the initial phone. The call function and WIFI communication of the graphene antenna phone are good, and the Bluetooth transmission rate of the graphene antenna phone can reach 172KB/s.

**Keywords**—graphene; mobile phone antenna; light weight;

## I. INTRODUCTION

In the past few years, mobile phone, as the necessity in modern society, has gradually changed from a simple communication tool, which only provides text and voice service, to the powerful intelligence equipment. Phone antenna, which is used to receive signals, is the most important component of mobile communications. Today, the vast majority of phone antenna material preparations are the precious metal materials such as copper, alloy material quality [1]-[2], which are heavy, expensive and complex production process. Using the metal to manufacture phone antennas is bound to increase costs, and the cooling of the metal antennas is also a big problem. Therefore, it is of great significance to find a suitable material to replace the metal material for mobile phone antenna design.

Recently, various allotropes of carbon based materials, such as graphene, carbon nanotubes and graphite are widely used in electronic fields. Excellent carbon based materials exhibit more advantages than many metal materials, such as light weight, flexibility, mechanical reliability, portability, optical properties, and reliability in harsh environments. Due to their good characteristics, various carbon based materials are used to fabricate RF microwave devices [3]-[5]. However, the conductivity of carbon based materials has a certain gap with the metal, and the performance of carbon antenna is not satisfactory. Therefore, the carbon based materials as the material to fabricate mobile phone antenna has not reported.

In this paper, we report a graphene film with conductivity of  $5 \times 10^6$  S/m and density of only  $1.5 \text{ g/cm}^3$  to fabricate the phone antennas, include main antenna, WIFI antenna and Bluetooth antenna. The call communication and WIFI communication of the graphene antenna phone are good, and the Bluetooth transmission rate of the graphene antenna phone can reach 172KB/s. The performance of graphene antenna mobile phone is comparable to the initial phone. By the way,

the processing technology of the graphene antenna is laser engraving.

## II. THE MANUFACTURING PROCESS

The graphene antennas of the phone are fabricated by the laser engraving machine. Three steps are demanded to prepare the graphene antennas—hot pressing, engraving, separate. Figure 1a is the graphene film. Firstly, the graphene film is attached to a PTFE substrate via 300 degrees centigrade hot pressing in order to provide convenience for laser engraving, as shown in figure 1b. After then, a LPKF laser engraving machine is used to cut the attached film to phone antenna according to the designed dimension and shape (figure 1c). Finally, the antennas are separate from the substrate, as shown in figure 1d. Figure 1e shows the process of fabricating antennas by laser engraving machine.

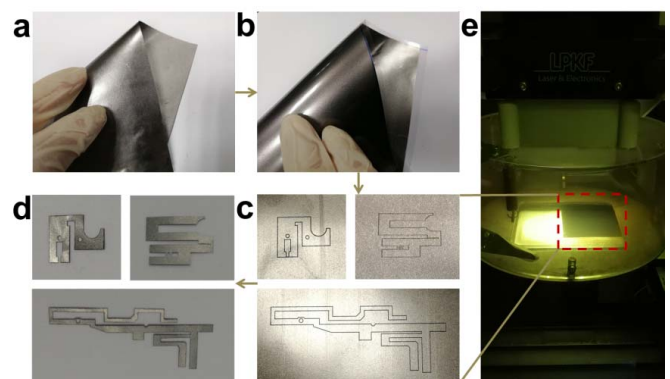


Figure 1 The manufacturing process of graphene mobile phone antennas

## III. RESULTS AND DISCUSSION

Applying the graphene antennas to a mobile phone, as shown in figure 2a. Figure 2b, c and d is WIFI antenna, Bluetooth antenna and main antenna, respectively. Figure 3 shows the working situation of graphene antennas mobile phone. As we can see, the signals of main communication and WIFI are good, and the Bluetooth switch has been turned on. It proves that the graphene main antenna, WIFI antenna and Bluetooth antenna work well. Figure 3 also verifies the call function of graphene antenna mobile phone is good. In order to verify the performance of graphene antenna mobile phones quantitatively, the Bluetooth transmission rate of graphene antenna mobile phone and the initial mobile phone is compared, as shown in figure 4. Two mobile phones have similar transmission rate of about 160 KB/s, and the highest rate of the graphene antenna phone is 172 KB/s. It's proved

that graphene antenna mobile phone has achieved the function of the initial mobile phone.

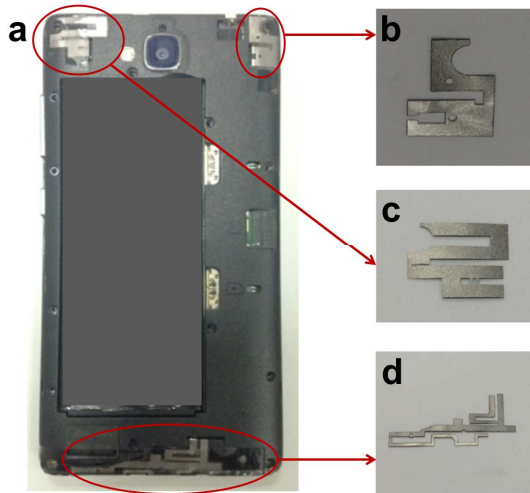


Figure 2 (a)The photo of graphene antenna phone; (b, c, d)The photo of graphene WIFI antenna, Bluetooth antenna, main antenna.

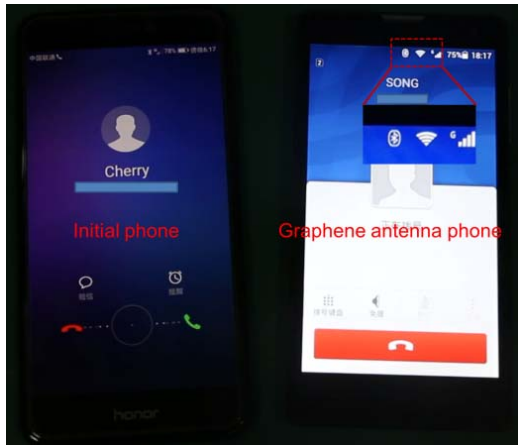


Figure 3 the working situation of graphene antennas mobile phone.

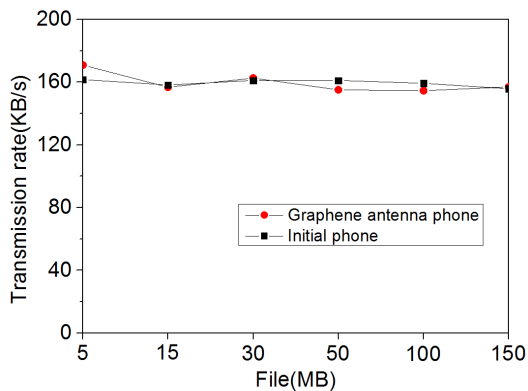


Figure 4 Comparison of Bluetooth transmission rate between graphene antenna mobile phone and the initial mobile phone.

#### IV. CONCLUSIONS

In this paper, graphene main antenna, WIFI antenna and Bluetooth antenna for mobile phone has been fabricated and investigated. The three antennas are made of the graphene film with conductivity of  $5 \times 10^6$  S/m and density of  $1.5 \text{g/cm}^3$  by laser engraving machine. The performances of graphene antenna mobile phone including call function, WIFI communication and Bluetooth transmission are as good as usually metal antenna phone. Therefore, our graphene antenna can completely replace metal antenna in mobile phones. Moreover, the graphene antenna is more lightweight, environmentally friendly and simple processing.

#### ACKNOWLEDGEMENT

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