Electronic Supplementary Material (ESI) for RSC Advances.

Flexible, Transparent and Ultrathin Single-Layer Graphene Earphone

--Supplementary Information

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I.Optical image of 1-6 layers of graphene

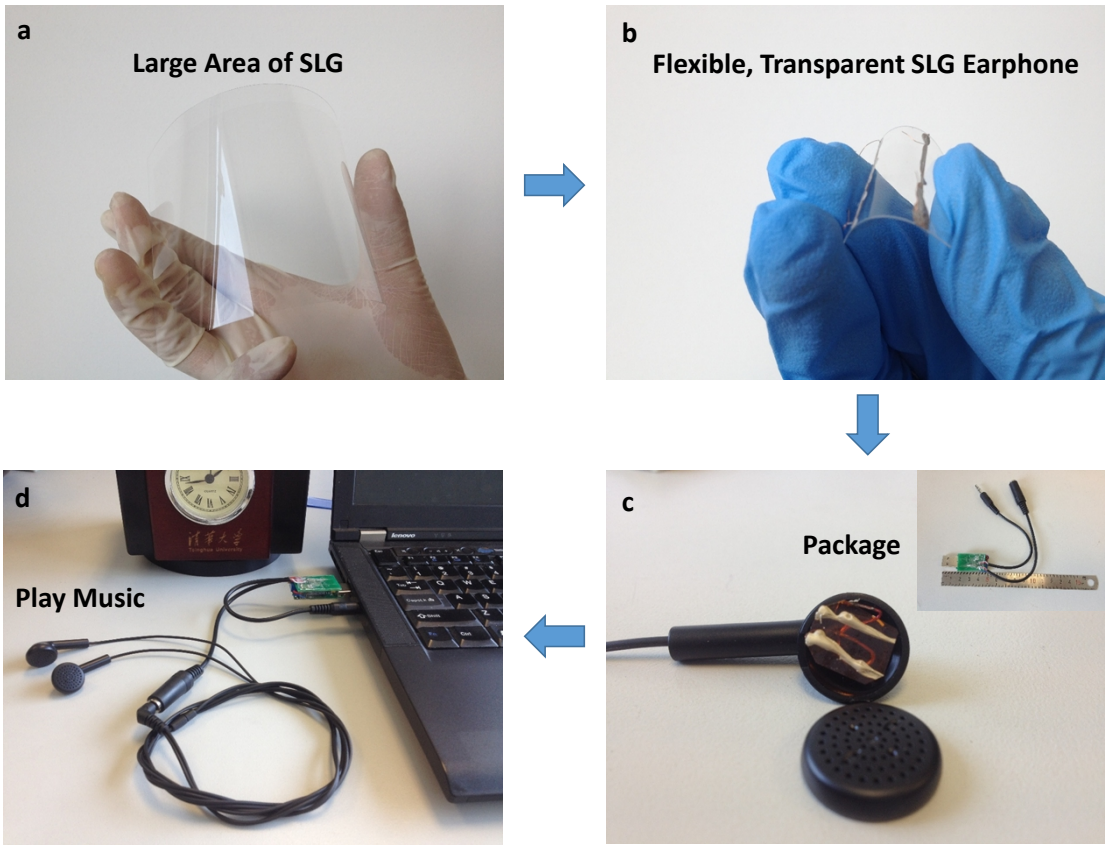

Figure S1. Real images of the fabrication process. (a) CVD growth of large-area of SLG and transferred on PET. (b) Cut SLG/PET into small piece and apply two electrodes. (c) Packaged by earphone case. Inset showing the driven circuit. (d) Connectted to the laptop for playing music.

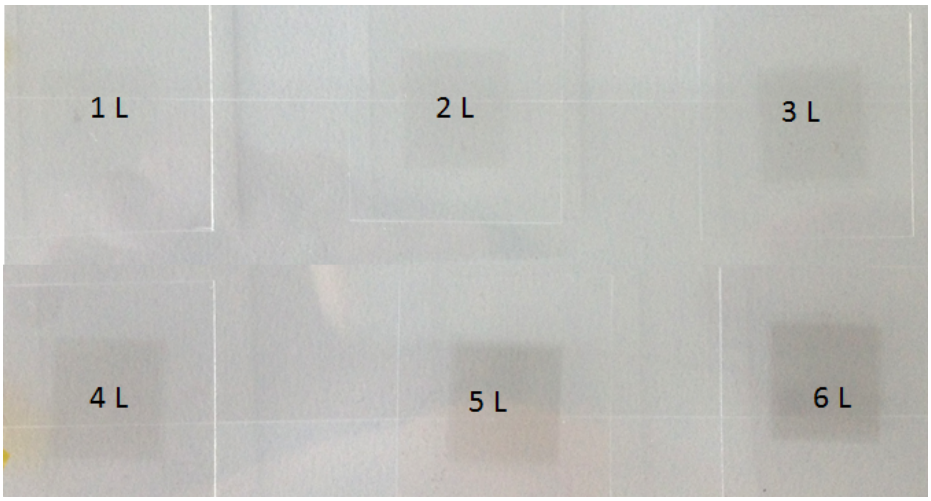

Figure S2. Optical images of 1 to 6 layers of stacked single-layer graphene (SLG) films on PET substrates by wet transfer. The SLG dimensions are 1 cm✕1 cm.

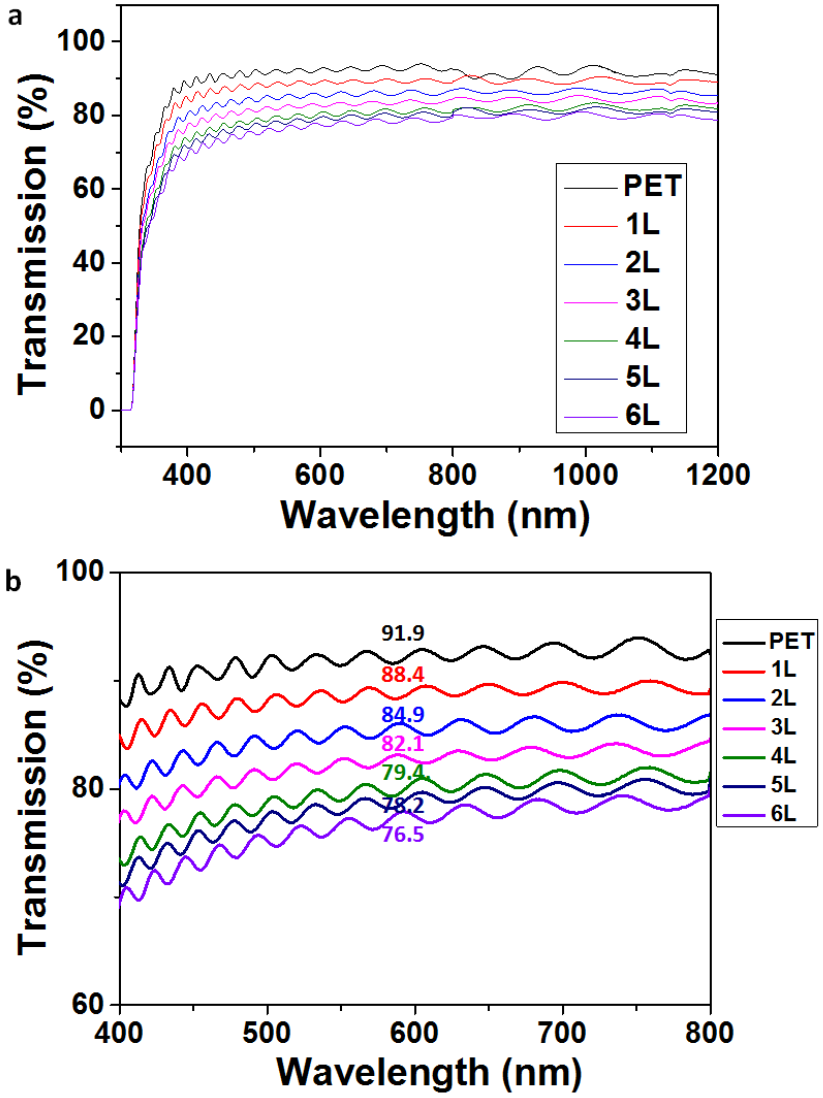

Figure S3. (a) The transmission of different graphene layers (n~1 to 6) in the 350nm to 1200nm range. (b) The zoom in figure showing the transmission in 400 nm to 800 nm range

The transmission of different graphene layers are shown in Figure S3. The transmission of the PET substrate is also tested as background. There is fluctuation for the PET transmission due to the light interference effect. With the increasing of the graphene layer number, the transmission decrease gradually. In the zoom in figure, average 2.6 % transmission lose for each graphene layer, which is similar to the theoretical value of 2.3 % for single layer graphene [1].

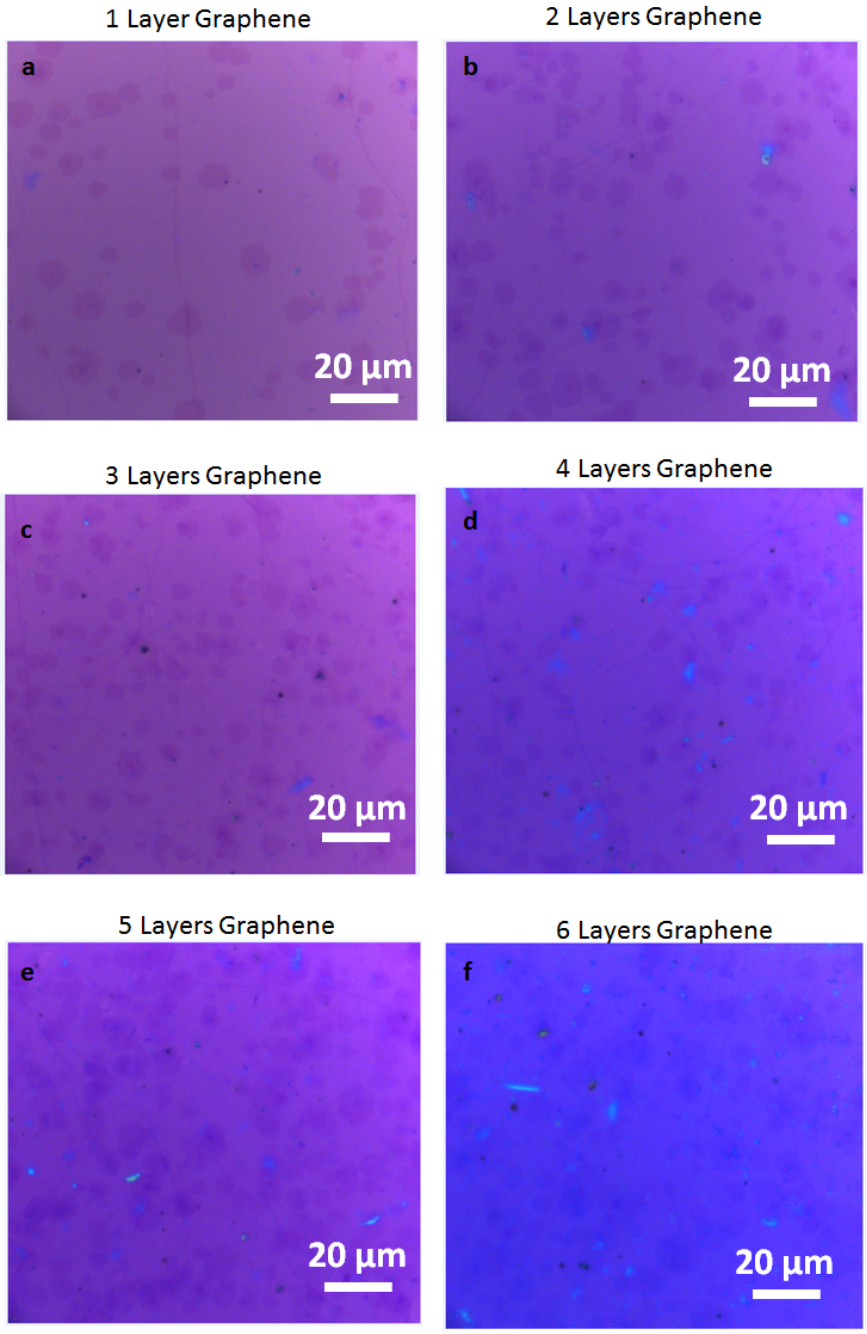

Figure S4. Micro images of 1 to 6 layers of stacked single-layer graphene (SLG) films on SiO_2 (300nm)/Si substrates by wet transfer.

II. Sound performance of 1-6 layers of graphene

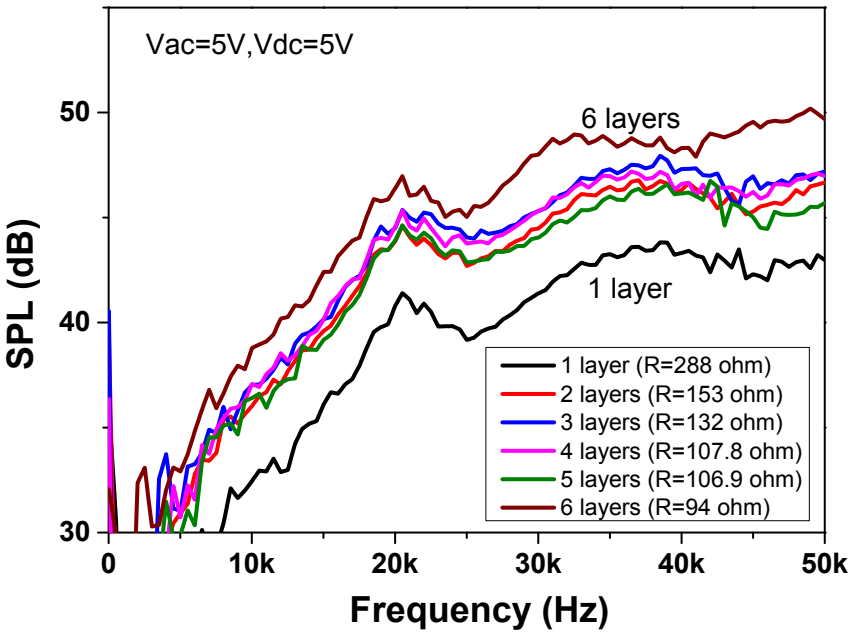

Figure S5. The SPL vs. frequency for different graphene layers under the same driving voltage.

The original results of SPL vs. frequency is shown in Figure S5. The six-layer graphene has the highest SPL value under the same driving voltage. However, the resistance of six-layer graphene is only 94 ohm, which is much lower than one-layer graphene. This means the input power for six layers are much higher than that of one-layer graphene. In order to make a fair comparison, the SPLs value are normalized to the same input power. And the results are shown in Figure 3a. The abnormal higher SPL for six-layer graphene may also be induced by the enhancement quality of graphene. Since the PET is roughness and single-layer graphene transfer on it could induce crack, which may decrease the sound performance. By stacking more graphene layers, the surface roughness decrease a lot and the quality of graphene enhanced, which could improve the sound quality finally.

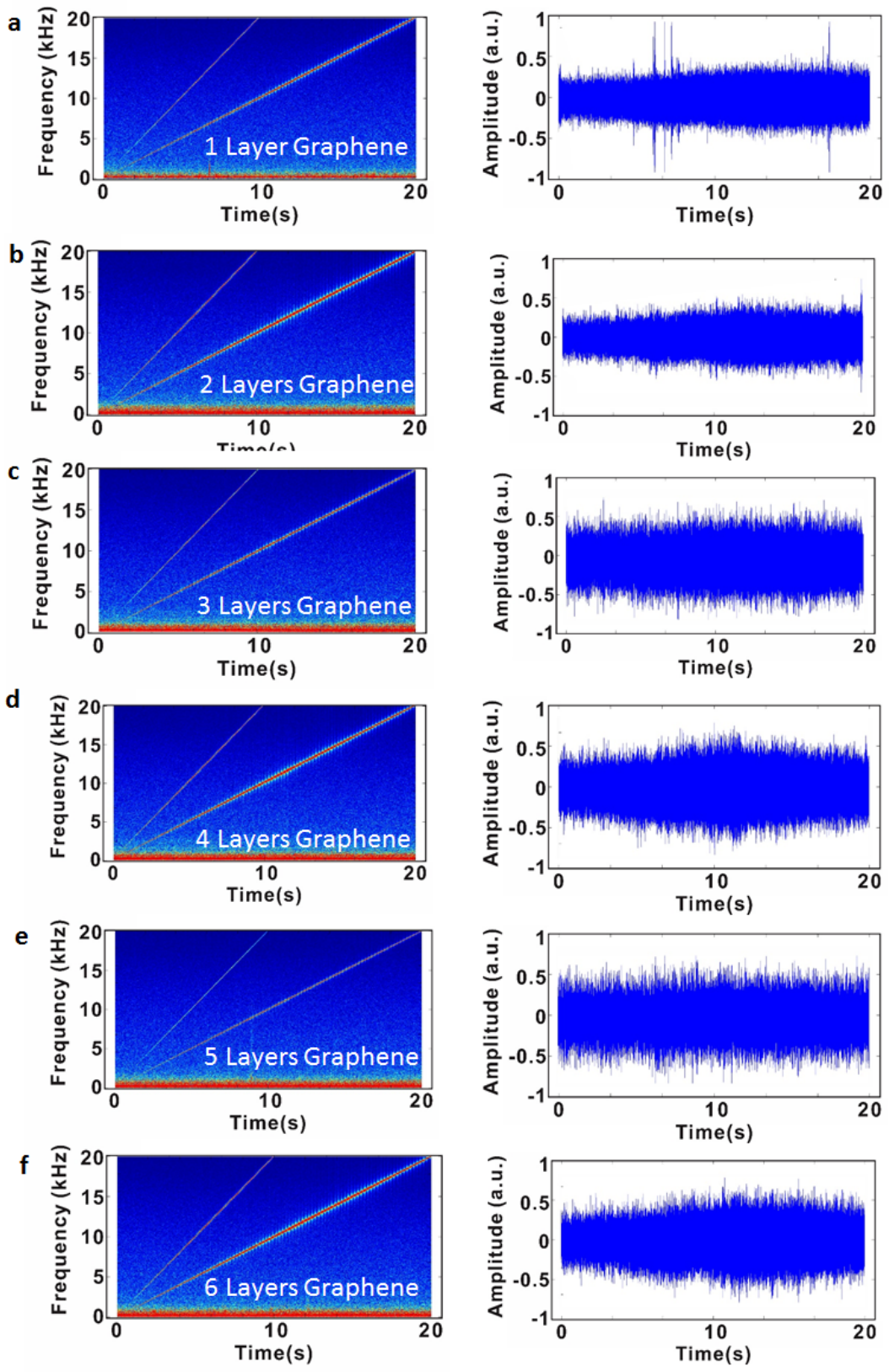

Figure S6. The amplitude spectrum and its Fourier transform of the sound generated by the 1 layer to 6 layers graphene (a~f) driven by an AC+DC signal.

Reference

[1] Nair R R, Blake P, Grigorenko A N, et al. Fine structure constant defines visual transparency of graphene. Science, 2008, 320(5881): 1308-1308.