Supplementary Information

The Selective Laser Sintering of Polyamide 11 /$BaTiO_3$ /Graphene Ternary Piezoelectric Nanocomposite

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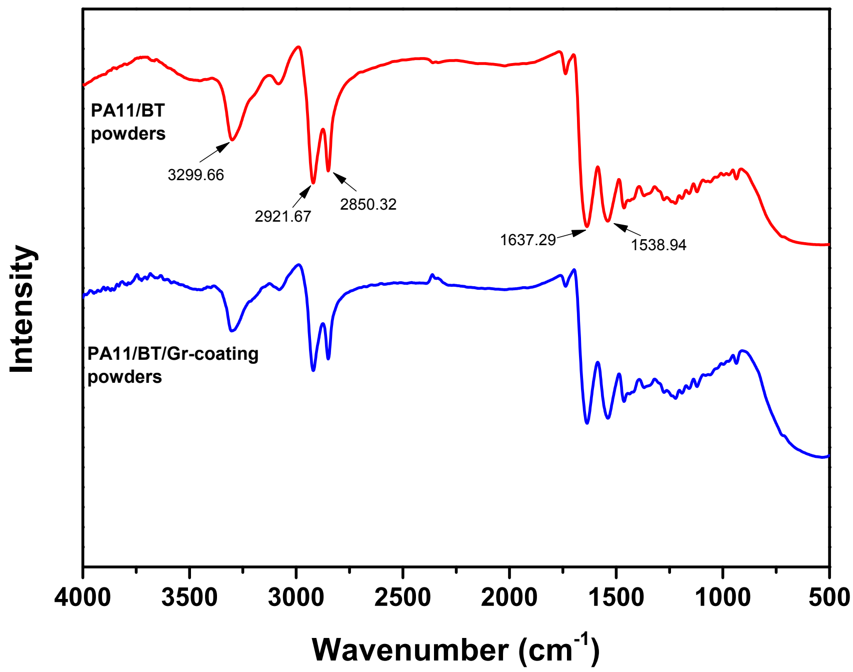

Fig. S1. The FT-IR spectra of the composite powder.

To explore the structure interaction between graphene PA11/$BaTiO_3$ composite powder during the ultrasonic coating process, we conducted the FT-IR measurement. Fig. S1. shows the infrared spectra of PA11/BT powders and PA11/BT/Gr-coating powders, from 500 to 4000 cm^{-1}. The result showed that there was no obvious chemical interaction occurring between graphene and PA11/$BaTiO_3$ composite, as the characteristic peaks of PA11 (Amide Ⅰ: υ=1637,29 cm^{-1}, Amide Ⅱ: υ=1538.94 cm^{-1}, -NH: υ=3299.66cm^{-1}, -CH_2: stretching vibrations υ=2921.67cm^{-1}, υ=2850.32cm^{-1}) do not shift and change after incorporating graphene. During the agitating process, the graphene dispersed in ethanol solution under ultrasonication and gradually deposited onto the surface of PA11/BT powders. The interaction between graphene and the composite powders was the van der Waals forces interfacial adhesion due to electrostatic interactions[1-3].

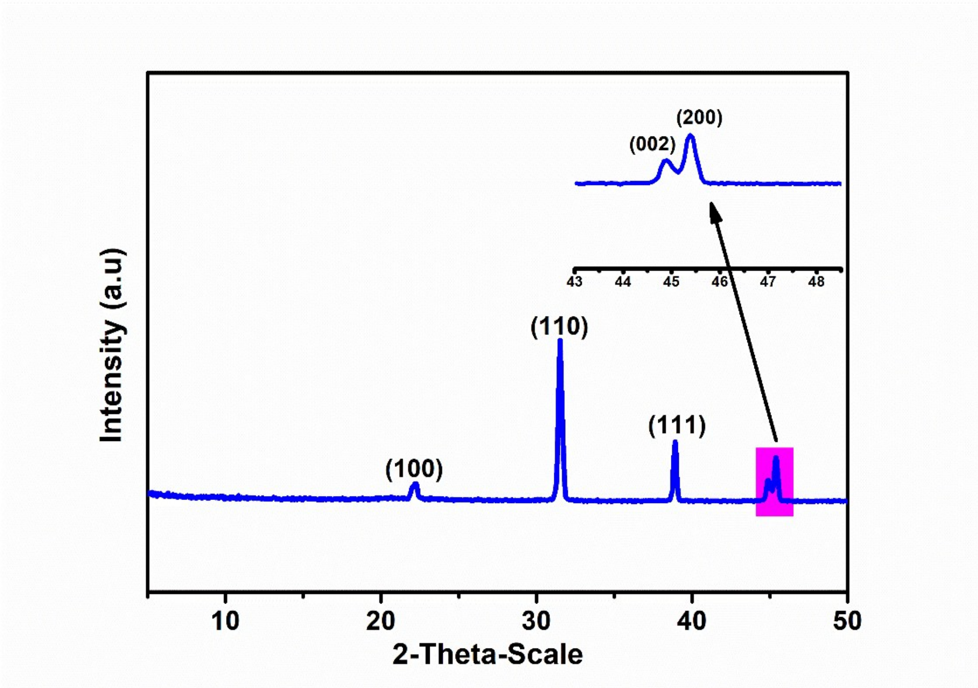

Fig. S2. X-ray diffraction patterns of the PA11/BT/Gr-coating parts. The inset is the detailed view from the peak highlighted in the full patterns.

$BaTiO_3$ has multiple Curie points and complex phase transition behavior. The crystal structure is not only related to temperature, but also to the particle size of the powder[4]. From Fig. 3(a) and its detailed descriptions, we have proved that the $BaTiO_3$ nanoparticles in the PA11/BT/Gr-coating powders exhibited typical tetragonal structures. To explore the crystalline development of $BaTiO_3$ during the heating and cooling process of SLS, XRD measurements of PA11/BT/Gr-coating parts were made as shown in Fig. S2. The XRD patterns showed four diffraction peaks in an angle (2θ) ranging from 5° to 50°, which could be attributed to the (100), (110), (111) and (200) reflections of perovskite $BaTiO_3$[5]. There was a splitting of the (200) reflection in the tetragonal form, with the lower angle shoulder indexed as (002)[6], indicating the $BaTiO_3$ nanoparticles in the PA11/BT/Gr-coating parts with an excellent ferroelectric tetragonal phase. Therefore, the $BaTiO_3$ nanoparticles still showed ferroelectric properties after SLS process.

References

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