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Supporting Information

Improved microwave absorption performance of double helical C/Co@CNT nanocomposite with hierarchical structures

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As shown in Fig. S1, ZIF-67 grown on HCNT and synthesized free MOF exhibits the similar diffraction peak to that of simulated ZIF-67, which means that they have the similar crystal structure and confirms the achievement of ZIF-67@HCNT.

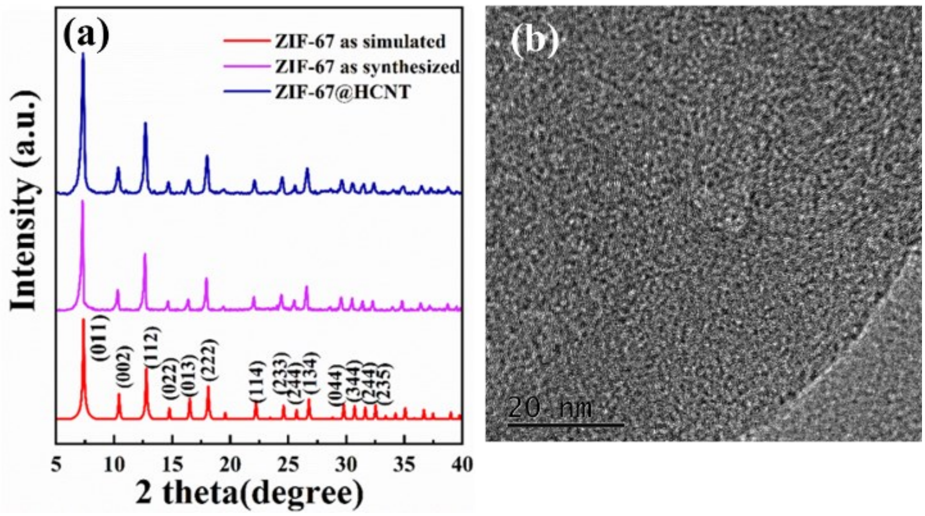

Fig.S1 (a) XRD spectrum of ZIF-67@HCNT, synthesized and simulated ZIF-67, (b)TEM image of ZIF-67 on HCNT.

As for ZIF-67@HCNT-3 as demonstrated in Fig. S2, except for pyrolysis under 700℃, the flexible CNT catalysed by Co particle are not present on HCNT surface. It is due to the catalytic activity of Co particle under 700℃ is the highest one to induce flexible CNT. With respect to 600℃, the Co catalytic activity is low under lower temperature. With the pyrolysis temperature increased to 800℃or 900℃, Co nanoparticles as catalysts were sintered at higher temperature. the particle size increased and gradually lost their catalytic activity for flexible CNT on HCNT.

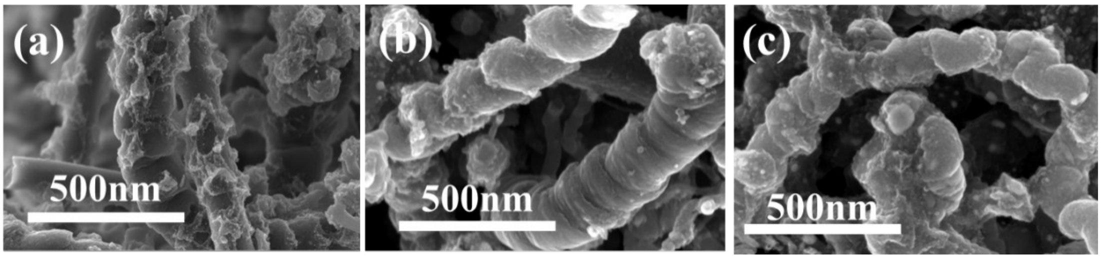

Fig.S2 SEM images of (a) C/Co@HCNT-3-600, (b) C/Co@HCNT-3-800, (c) C/Co@HCNT-3-900.

As shown in Fig. S3ac, both as received HCNT and pyrolyzed ZIF-67 exhibit low microwave absorption property compared with hierarchically double helical C/Co@CNT nanocomposites.

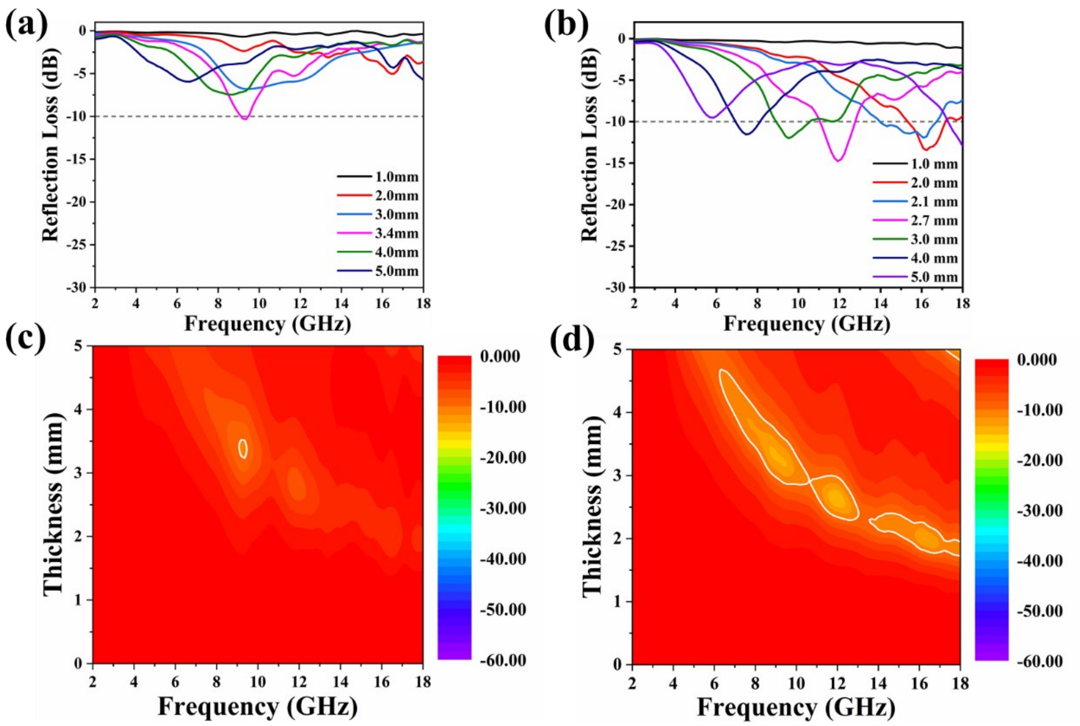

Fig.S3 Reflection loss curves and the corresponding 2D plots of (a, c) as received HCNT, (b, d) pyrolyzed ZIF-67.

Due to coexisting of right-helical and left-helical structure in as received HCNT, these helical belt layers also show two helical forms. Therefore, as exhibited in Fig. S4, the chirality of composites could not readily observed in the circular dichroism spectra.

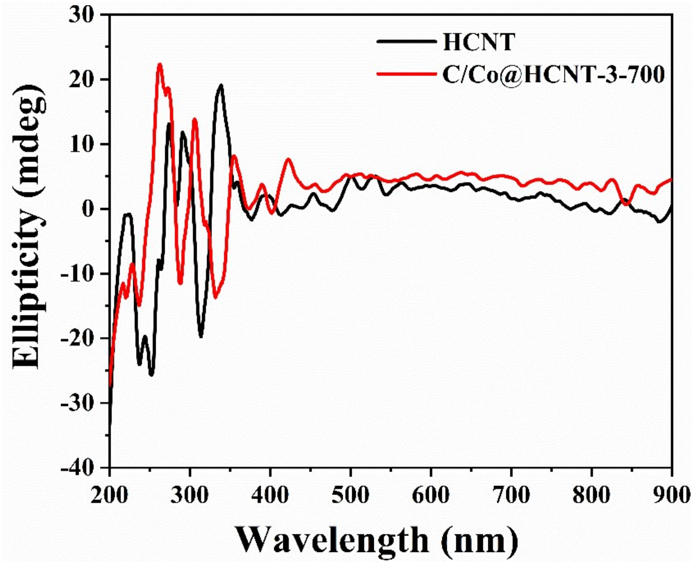

Fig.S4 Circular dichroism spectra of HCNT and C/Co@HCNT-3-700

In order to verify the improved microwave absorption properties of C/Co@HCNT-3-700, properties of as received HCNT, other three C/Co@HCNT nanocomposites and pyrolyzed free ZIF-67 were also carried out. The value of Z_{in}/Z_0 corresponding to HCNT (Fig. S5a) and pyrolyzed ZIF-67 (Fig. S5e) are greater than 1 obviously which means that they have poor impedance matching. As shown in Fig. S5b, the Z_{in}/Z_0 value of C/Co@HCNT-3-600 is close to 1 with the thickness of 5 mm. However, it presents limited microwave absorption performance due to weak attenuation constant. C/Co@HCNT-3-800 (Fig. S5c) and C/Co@HCNT-3-900 (Fig. S5d) present degraded impedance matching ability.

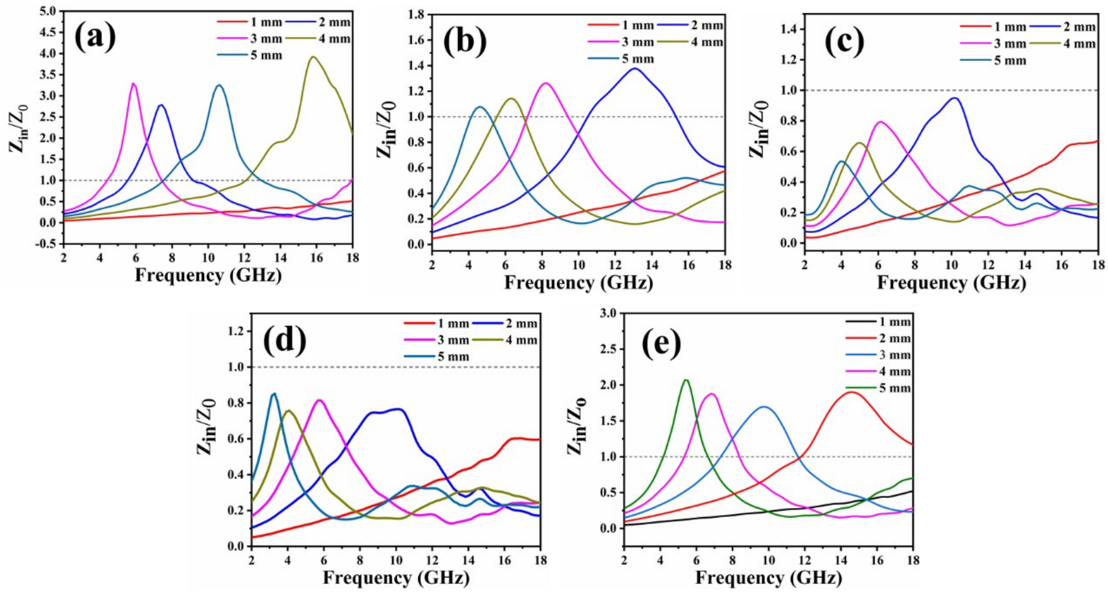

Fig.S5 Impedance matching corresponding to thickness and frequency of (a) HCNT, (b) C/Co@HCNT-3-600, (b) C/Co@HCNT-3-800, (b) C/Co@HCNT-3-900, and (e) pyrolyzed ZIF-67.