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基于核壳结构 Co_3Fe_7@C 的高效微波吸收材料

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Core-Shell Co_3Fe_7@C Composite as Efficient Microwave Absorbent

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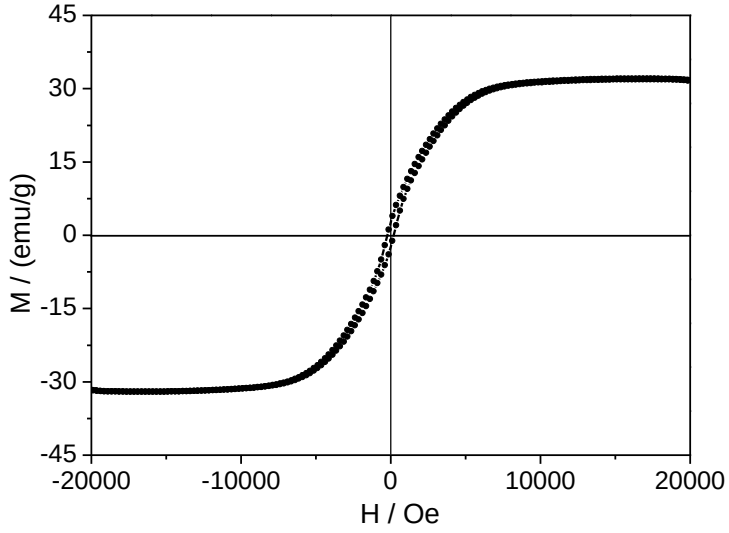

Fig.S1 Magnetic hysteresis loop of core–shell Co_3Fe_7@C composite at 300 K

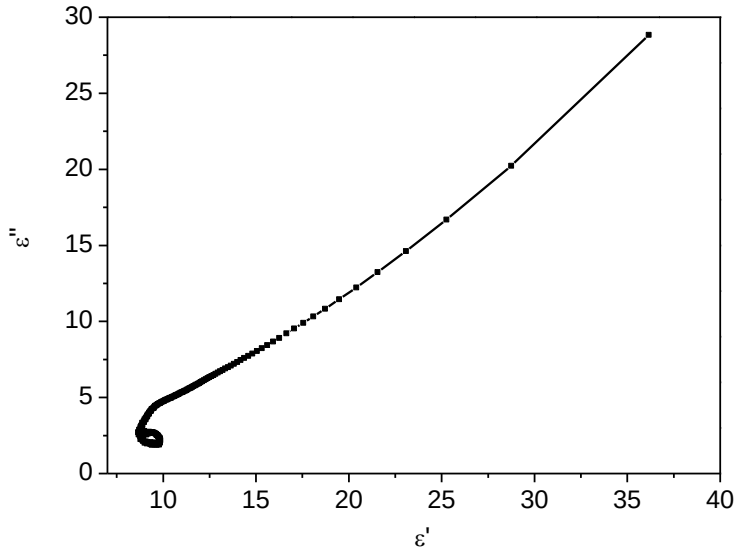

Fig.S2 Typical Cole–Cole semicircles (ε' versus ε'') for core–shell Co_3Fe_7@C composite in the frequency range of 2–18 GHz

Fig. S2 shows the curve of ε' versus ε'' for Co_3Fe_7@C composite. It is well accepted that the interfacial polarization and associated relaxation will enhance the absorption property, which can be validated by the Cole–Cole semicircle. According to the Debye dipolar relaxation, [1] the relative complex permittivity (ε_r) can be written as

$$\varepsilon_\gamma = \varepsilon' + i\varepsilon'' = \varepsilon_\infty + \frac{\varepsilon_S - \varepsilon_\infty}{1 + i\omega\tau_0} \quad (1)$$

where τ_0、ε_s and ε_∞ are the relaxation time, the static dielectric constant, and the dielectric constant at infinite frequency. From equation 1, it can be deduced that

$$\varepsilon' = \varepsilon_\infty + \frac{\varepsilon_S - \varepsilon_\infty}{1+(\omega\tau_0)^2} \quad (2)$$

$$\varepsilon'' = \frac{\omega\tau_0(\varepsilon_S - \varepsilon_\infty)}{1+(\omega\tau_0)^2} \quad (3)$$

based on equation 2 and 3, it can be further deduced that the relationship between ε' and ε'' is as follows

$$\left(\varepsilon' - \frac{\varepsilon_S+\varepsilon_\infty}{2}\right)^2 + (\varepsilon'')^2 = \left(\frac{\varepsilon_S - \varepsilon_\infty}{2}\right)^2 \quad (4)$$

thus the plot of ε' versus ε'' would be a single semicircle, which is usually defined as the Cole–Cole semicircle, and each semicircle corresponds to one Debye relaxation process. [2]

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