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Supporting Information

Synthesis of hierarchical dendritic micro-nano structure Co_xFe_{1-x} alloy with tunable electromagnetic absorption performance*

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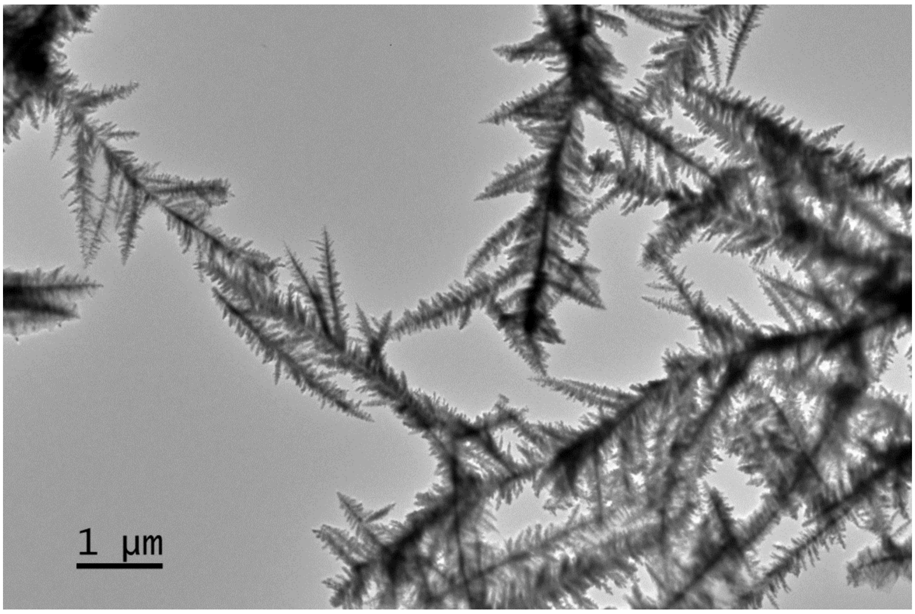

Figure S1. TEM image of the grain-like dendritic micro-nano structure ε-Co.

As shown in Figure S1, many different small sections link together and form the long grain-like dendritic structure. The branch width of long grain-like dendritic ε-Co is less than 1 μm.

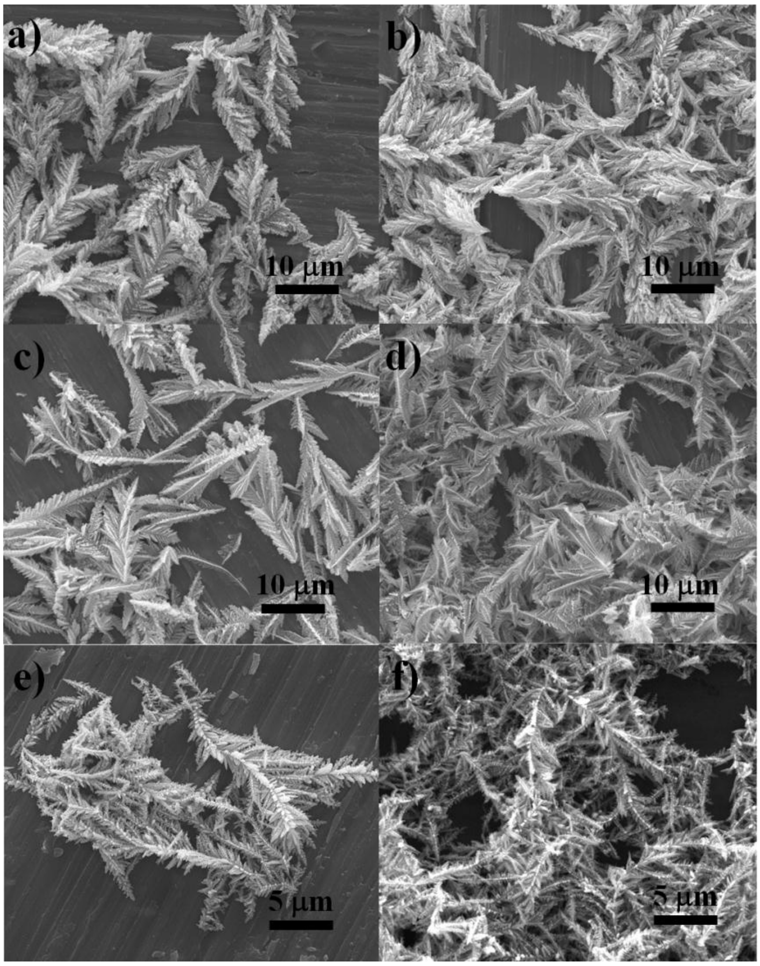

Figure S2. Low-magnification SEM images of leaf-like dendritic a) $Co_{0.1}Fe_{0.9}$, b) $Co_{0.3}Fe_{0.7}$, c) $Co_{0.5}Fe_{0.5}$ and d) $Co_{0.7}Fe_{0.3}$ alloys, and grain-like dendritic e) $Co_{0.9}Fe_{0.1}$ alloy and f) ε-Co.

From these low-magnification SEM images shown in Figure S2, it can be observed that every specimen in different dendritic Co_xFe_{1-x} alloys shows a similar shape and size, which indicates that this method could uniformly fabricate both the hierarchical leaf-like dendritic Co_xFe_{1-x} alloys (x = 0.1, 0.3, 0.5 and 0.7) and the smaller size hierarchical grain-like dendritic Co and $Co_{0.9}Fe_{0.1}$ alloy. The grain-like dendritic ε-Co has a smaller size than that of leaf-like dendritic Co_xFe_{1-x} alloys. This method is repeatable which is of great significance for practical application.

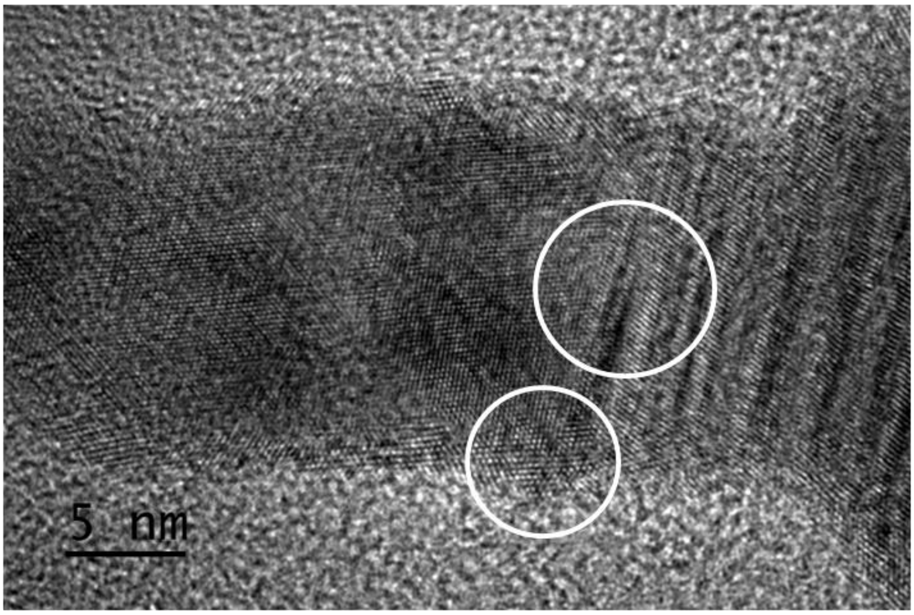

Figure S3. HRTEM image of the grain-like ε-Co branch.

Figure S3 shows the obvious dislocation and twins which could act as polarized centers. These defects are contributed to enhancing the electromagnetic absorption performance.

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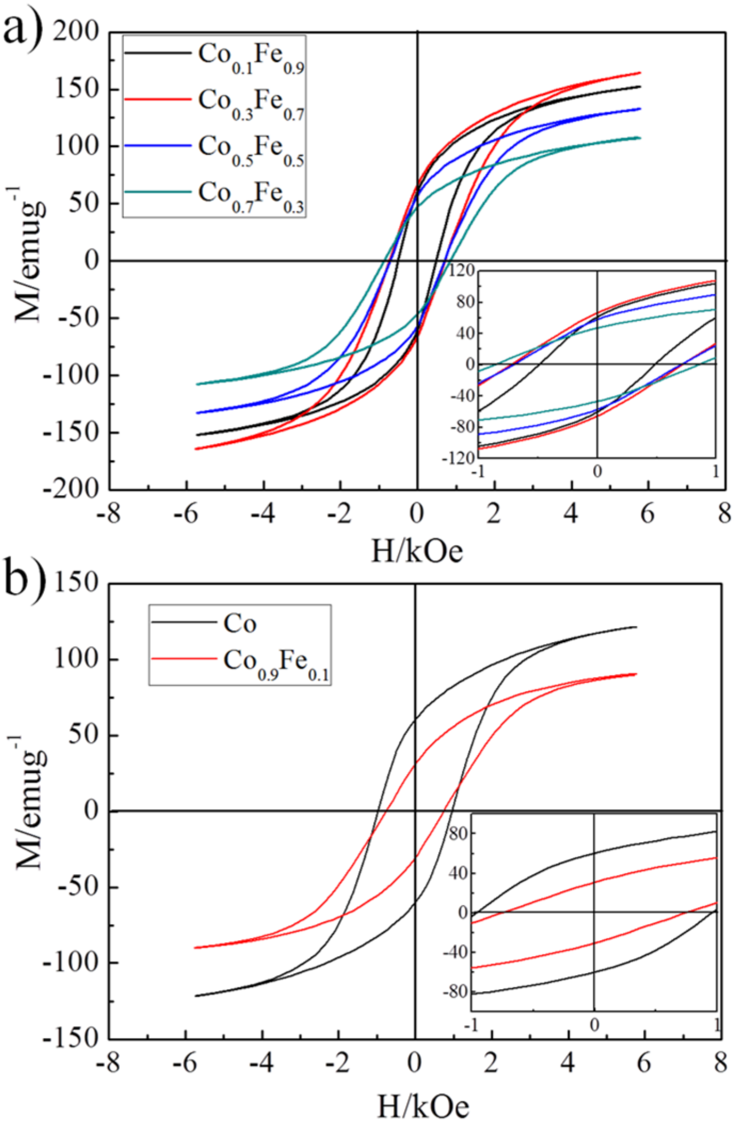

Figure. S4 Magnetic hysteresis loops (M-H loops) of a) leaf-like dendritic Co_xFe_{1-x} (x= 0.1, 0.3, 0.5 and 0.7) and b) grain-like dendritic $Co_{0.9}Fe_{0.1}$ and ε-Co at room temperature. The inset is the expanded low-field hysteresis curves.

Figure S4 shows that hierarchical dendritic Co_xFe_{1-x} alloys have large saturation magnetizations and coercivities. The coercivity has a rough rising trend from 489.97 Oe for $Co_{0.1}Fe_{0.9}$ to 857.51 Oe for $Co_{0.7}Fe_{0.3}$ when the Co content in the alloys increases. With the Co content further increasing, the coercivity of hierarchical grain-like dendritic $Co_{0.9}Fe_{0.1}$ alloy decreases to 746.47 Oe due to its mixture crystal structure. The pure grain-like dendritic ε-Co has maximum coercivity value (962.44 Oe).

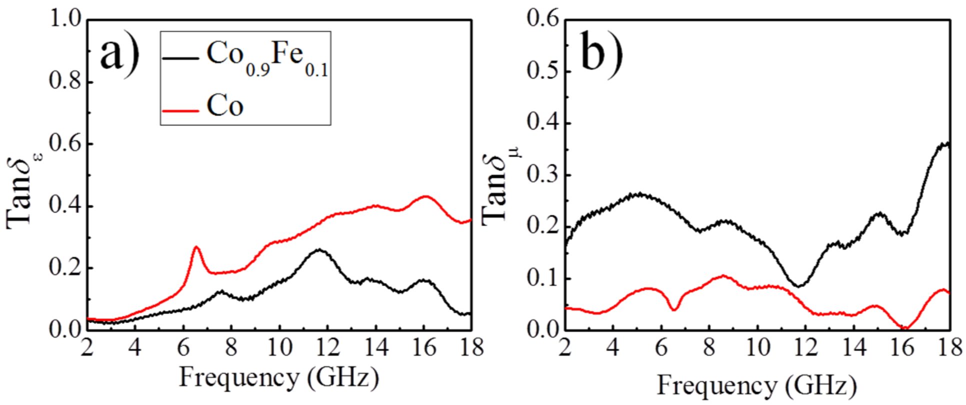

Figure S5. a) The dielectric loss tangents ($\tan\delta_\varepsilon = \varepsilon''/\varepsilon'$) and b) magnetic loss tangents ($\tan\delta_\mu = \mu''/\mu'$) of grain-like dendritic micro-nano structure $Co_{0.9}Fe_{0.1}$ alloys and ε-Co under different frequencies.

From Figure S5, it can be known that grain-like dendritic ε-Co has a larger dielectric loss than that of grain-like dendritic $Co_{0.9}Fe_{0.1}$ alloy in the whole frequency range. But its magnetic loss is less than 0.1 in the whole frequency range which is almost a half of ε-Co magnetic loss. This result indicates that the excellent EMA performance of grain-like ε-Co mainly derives from the large dielectric loss while the magnetic loss plays a primary role for grain-like dendritic $Co_{0.9}Fe_{0.1}$ alloy.