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Controlled synthesis and microwave electromagnetic properties of micro–nano MnO₂ powder

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ABSTRACT

The manganese dioxides, in combination with their novel chemical and physical properties, have paved the way for their wide use as catalysts and electrochemical materials, but the microwave absorption properties of MnO₂ have not been exploited. Our research group has found that manganese dioxides own excellent dielectric loss. However, the magnetic loss is relatively low. Besides, the low frequency absorption performance is relatively poor, and the bandwidth is relatively narrow. On these bases, our research group synthesized new type of manganese dioxides absorbent in high magnetic field and by doping with magnetic cations. As a result, we found that the magnetic loss was significantly enhanced, and the effective absorption bandwidth was broadened evidently as well. After Ni/Co doping, the phase structure and morphology of α -MnO₂ were kept the bunchy nanowires as those before doping, while the imaginary part of complex permittivity and the dielectric loss tangent were increased with evident frequency response character. The effects of Fe doping on dielectric property of MnO₂ were different from those of Ni/Co doping. Both the phase structure and morphology were changed after Fe doping. The morphology of Fe-doped MnO₂ was hollow sea urchin ball-like shape, and at the same time, the real and imaginary parts of complex permittivity and dielectric loss tangent were all decreased with the increased Fe doping concentration.