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# Facile synthesis of hierarchical chrysanthemum-like copper cobaltate-copper oxide composites for enhanced microwave absorption performance

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**Abstract** Hierarchical chrysanthemum-like  $\text{CuCo}_2\text{O}_4\text{-CuO}$  composites were successfully synthesized by a facile one-pot hydrothermal method after calcination at 500 °C. Based on the results of X-ray diffraction (XRD), Raman spectra, thermogravimetric analysis (TGA) and transmission electron microscope (TEM), we found that not only the morphology (from 2 dimensional to 3 dimensional) but also the crystalline structure ( $\text{Cu}^0 + \text{Cu}_2\text{O} + \text{CoO}_x \rightarrow \text{CuO} + \text{CuCo}_2\text{O}_4$ ) of the samples could be tuned by the calcination temperature. The existed interfaces of  $\text{CuCo}_2\text{O}_4\text{-CuCo}_2\text{O}_4$ ,  $\text{CuCo}_2\text{O}_4\text{-CuO}$ , and  $\text{CuO-CuO}$  played a key role on the attenuation of electromagnetic waves. The effective absorption frequency bandwidth is up to 4.02 GHz with a matched thickness of 2.8 mm. The  $\text{CuCo}_2\text{O}_4\text{-CuO}$ /paraffin composites can even exhibit bigger effective frequency bandwidth (from 4.02 to 4.65 GHz) if we turn the incident angle of electromagnetic (EM) wave to a proper value (*i.e.*, 45 °). We believe

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