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SiO_2纳米壳的厚度对羰基铁/SiO_2核壳复合粒子的性能影响

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摘要 以聚乙烯吡咯烷酮作表面改性剂, 用溶胶-凝胶法, 通过控制反应时间, 在羰基铁粒子表面均匀快速地包覆不同厚度的SiO_2纳米壳层, 并研究了SiO_2纳米壳层厚度对羰基铁/SiO_2核壳复合粒子的抗热氧化性能、静磁性能、微波介电常数和吸波性能的影响. 结果表明: 增加SiO_2纳米壳层的厚度, 羰基铁/SiO_2核壳复合粒子的抗热氧化能力提高, 比饱和磁化强度出现最大值, 矫顽力和剩余磁化强度出现最小值, 微波介电常数单调降低; 用其制备的吸波涂层材料在壳层厚度为15nm时, 反射损耗≤--8dB的带宽达到最大值, 超过10GHz.

关键词 核壳结构 羰基铁 二氧化硅 微波吸收

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Properties of Fe/SiO_2 Core-shell Composite Particles with Different Nanoshell Thickness

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Abstract Using a sol-gel route with polyvinyl pyrrolidone as the surfactant, the carbonyl iron microparticles were uniformly and fleetly coated by SiO_2 nanoshell, whose thickness was conveniently different by changing reaction time. The influences of shell thickness on the properties of the Fe/SiO_2 core-shell particles were studied. The results show that increasing the thickness of SiO_2 nanoshell (D_{shell}), the anti-oxidation property of the Fe/SiO_2 core-shell composite particles is obviously improved while microwave permittivity decreased monotoneously. The saturation magnetization shows a maximum value while both the coercivity and remnant magnetization show minimum values at D_{shell}=15nm. Meanwhile, the radar absorbing coating based on the Fe/SiO_2 core-shell composite particles with D_{shell}=15nm shows a maximum bandwidth of more than 10GHz, in which the reflective loss is less than --8dB.

Key words core-shell particles carbonyl iron silica microwave absorbing

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