

Magnetic Properties of Fe alloy/SiO₂ core/shell structure powder

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Fe metal powder which exhibits excellent soft magnetic behavior has been used for inductors or converters. Even though Fe exhibits high saturation magnetization with very low coercivity, its applications are limited by high AC losses at high frequency regime, which is not avoidable because of metallic property of Fe. To reduce the eddy current loss, insulating coating on the Fe powder to increase electrical resistivity can be applied. For this reason, we tried to fabricate Fe alloy/SiO₂ core/shell structure powder, which blocks inter-particle eddy current path within the sample. SiO₂ insulation coating was performed by sol-gel method using Tetraethyl orthosilicate (TEOS) as its precursor via sol-gel processing. TEOS concentration and coating time were controlled for an optimization. The SiO₂ coating layer was confirmed by TEM, and magnetic properties of SiO₂-coated Fe alloy powder, including permeability, Q factor and core loss, were measured for an evaluation. Permeability of SiO₂ coated samples was decreased as increased TEOS concentration and coating reaction time. Core loss was observed to be decreased by SiO₂ insulating layer, which was confirmed by TEM analysis. Details will be presented for a discussion.

This work was supported by a Grant from *world class 300* (0417-20150129).

Keywords : Fe powder, SiO₂ coating, insulating coating, eddy current loss