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Computer Simulation to Investigate Magnetic and Wave-Absorbing Properties of Iron Nanoparticles

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Abstract : A recent surge in research on magnetic radar absorbing materials (RAMs) has presented researchers with new opportunities and challenges. This study was performed to gain a better understanding of the wave-absorbing phenomenon of magnetic RAMs. First, we hypothesized that the absorbing phenomenon is dependent on the particle shape. Using the Material Studio program and the micro-dot magnetic dipoles (MDMD) method, we obtained results from magnetic RAMs to support this hypothesis. The total MDMD energy of disk-like iron particles was greater than that of spherical iron particles. In addition, the particulate aggregation phenomenon decreases the wave-absorbance, according to both experiments and computational data. To conclude, this study may be of importance in terms of explaining the wave- absorbing characteristic of magnetic RAMs. Combining molecular dynamics simulation results and the theory of magnetization of magnetic dots, we investigated the magnetic properties of iron materials with different particle shapes and degrees of aggregation under external magnetic fields. The MDMD of the materials under magnetic fields of various strengths were simulated. Our results suggested that disk-like iron particles had a better magnetization than spherical iron particles. This result could be correlated with the magnetic wave-absorbing property of iron material.

Keywords : wave-absorbing property, magnetic material, micro-dot magnetic dipole, particulate aggregation
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