AA05

Magnetic Nanoparticles for Bio-medical Applications

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For bio-medical applications, magnetic nanoparticles have to become bio-functionalized. It could be achieved by binding anti-bodies onto magnetic nanoparticles. In addition to the preparation processes, the physical and bio-active properties of bio-functionalized magnetic nanoparticles are characterized. We then investigate the feasibility of using bio-magnetic nanoparticles for immunoassay, gene magneto-delivery, and cell sorting. These results reveal such advantages as high-convenience, high-specificity, high-sensitivity, and high-efficiency in bio-medical applications using magnetic nanoparticles.

AA06

Heating Ability of Iron Oxide Nanoparticles at 120-900 kHz for Magnetic Anticancer Hyperthermia

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This paper reports on the ability of iron oxide (Fe_3O_4/γ-Fe_2O_3 intermediate) nanoparticles to heat water for anticancer *hyperthermia under alternating magnetic field at frequencies*, f = 120-900 kHz. We synthesized ferrite nanoparticles with various average primary particle sizes, d = 8-40 nm [1]. They were coated with different amounts of citric acid and dispersed into water with various secondary particle sizes, D.

Fig. 1 shows that particles with 18±5 nm produced a significant temperature rise when D = 54 nm and 72 nm. Even when completely coagulated to D = 5500 nm, the temperature rise remained about 50% of the original values. On the other hand, smaller particles with d = 8±2 nm did not yield appreciable temperature rise even when coagulated to D = 57 nm. This means that the heating ability is essentially determined by primary particle size and that dipolar interactions between the primary particles are weak. Otherwise heat generation (which is primarily ascribed to Néel relaxation) is enhanced by coagulation.

Fig. 2 shows the specific absorption rate (SAR) measured at 120, 500, and 900 kHz for particles with different d. When 82 and 185 nm, the observed SAR fitted with our calculation, but decreased when 406nm. This is because Brownian relaxation contributes to the bigger particles, which is reduced by coagulation.

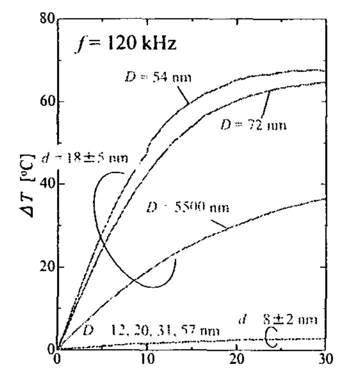

Fig. 1. Time dependence of temperature rise obtained at f = 120 KHz.

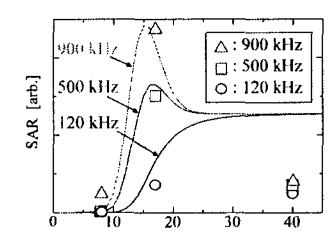

Fig. 2. SAR measured and calculated for particles with different primary particle sizes d. Circles, squares, and triangles show observation, and lines show calculation.

REFERENCE

[1] K. Okawa, M. Sekine, M. Maeda, M. Tada, and M. Abe, J. Appl. Phys. 99, 08H102, (2006).