DT03

Measurement of Fetal Magnetocardiography Signals Using an Axial Type First-order SQUID Gradiometer System

K. K. Yu, Y. H. Lee*, K. Kim, J. M. Kim, H. Kwon, H. K. Lim, C. S. Kang, and Y. K. Park
Medical Metrology center, Korea Reaserch Institute of Standards and Science, Deajon 305-340, Korea
*Corresponding author: Y. H. Lee, e-mail: yhlee@kriss.re.kr

We have fabricated a low-noise 61-channel axial type first order gradiometer system for measuring fetal magnetocardiography (MCG) signals. Superconducting quantum interference device (SQUID) sensor was based on double relaxation oscillation SQUID (DROS) for detecting biomagnetic signal[1], such as MCG[2], magnetoencphalogram (MEG)[3] and fetal-MCG[4]. The SQUID sensor detected axial component of fetal MCG signal. The pickup coil of SQUID sensor was wounded with 120 μm NbTi wire on bobbin (20 mm diameter) and was a first order gradiometer to reject the environment noise. The sensors have low white noise of 3 $fT/Hz^{1/2}$ at 100 Hz, averagely. The fetal MCG was measured from 24~36 weeks fetus in a magnetically shielded room (MSR) with 35 dB, 80 dB shielding factor at each of 0.1 Hz and 100Hz (comparatively mild shielding). The MCG signal contained maternal and fetal MCG. Fetal MCG could be distinguished from maternal MCG by using independent component analysis (ICA) filter[5]. In addition, we could observe T peak as well as QRS wave, respectively. It will be useful to detect fetal cardiac diseases

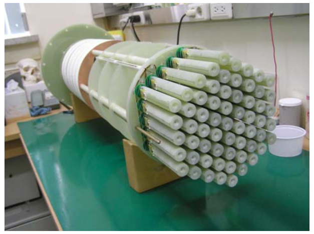

Fig. 1. Photograph of 61channel SQUID insert to measure biomagnetic field.

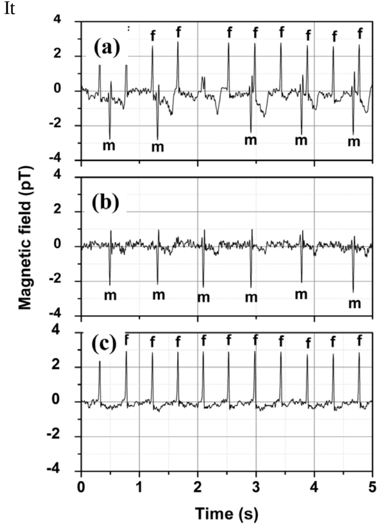

Fig. 2. Separated fMCG and mMCG signal from measured signal using ICA filter;(a) measured signal, (b) maternal MCG, (c) fetal MCG.

REFERENCES

[1] Y. H. Lee *et al*., J. De Physique IV, 4, PP 255-260 (1997).
[2] H. K. Lim *et al*., Annals of Biomedical Engineering , 35, pp. 59-68 (2007).
[3] K. Sata *et al*., IEEE Trans. Appl. Supercond., 7, pp. 2526-2529 (1997).
[4] R. Stolz *et al*., Supercond. Sci. Technol., 16, pp. 1523-1527 (2003).
[5] D. Mantini *et al*., IJBEM, 7, pp. 251-254 (2005).

DT04

Applicability of Radioactive $^{99m}Tc\text{-}O_4^-$ Magnetic Fluid to Mdicine

Jong-Hee Kim[1]*, Seong-Min Kim[2], Chong-Oh Kim[1], and Keun-Ho Kim[2]
[1]Research Center for Advanced Magnetic Materials, Chungnam Nat'l University, Daejeon 305-764, Korea
[2]Dept. of Nuclear Medicine, Chungnam Nat'l University Hospital, Daejeon 301-721, Korea
*Corresponding author: Jong-Hee Kim, e-mail: sjh@cnu.ac.kr

Magnetite nanoparticles were synthesized by sonochemical method. In order to prepare hydrophilic magnetic fluids, technetium pertechnetate ($^{99m}Tc\text{-}O_4^-$) and alginic acid were in turn adsorbed onto the surface of the magnetite particles. The magnetic fluids were freezed and dried to gather the dispersed particles. The total size of the particles was about 15 ㎚ and their saturation magnetization value 66 emu/g. In order to apply the nanoparticles to medical science, the particle size distribution and the colloidal dispersibility need to be satisfied simultaneously with a high saturation magnetization of superparamagnetism as shown in Fig. 1 [1,2]. The labeling efficiency of radiopharmaceutical $^{99m}Tc\text{-}O_4^-$ was as high as 70 %, which could be potentially applied to nuclear medicine. Such a percentage value is very high compared with the adsorption rate 12.5 % [3] of photosensitizer onto the magnetic nanoparticles.

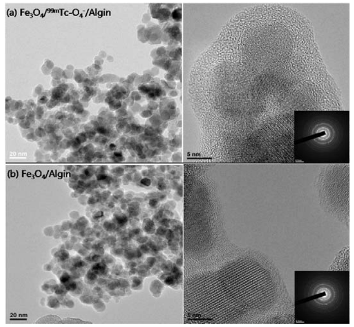

Fig. 1. TEM images for fluids of magnetic particles algin-adsorbed (a) with and (b) without $^{99m}Tc\text{-}O_4^-$ labeling. The inserted SAED pattern reveals high crystallinity.

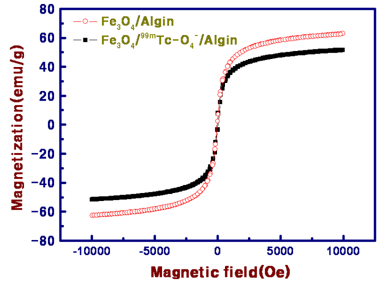

Fig. 2. Magnetization curves of magnetite particles algin-adsorbed with and without $^{99m}Tc\text{-}O_4^-$ labeling.

REFERENCES

[1]] S. W. Lee, K. J. Woo, C. S. Kim, J. Magnetics, 9(3), 83 (2004).
[2]] Z. G. M. Lacava, R. B. Azevedo, E. V. Martins, L. M. Lacava et al., J. Magn. Magn. Mater., 201, 431 (1999).
[3]] S. I. Park, J. H. Lim, J. H. Kim, H. I. Yun, and C. O. Kim, IEEE Transactions on Magnetics, 41(10), 4111 (2005).