

Detection of magnetic nanoparticles in deep position by using pulsed magnetic field IV

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Breast cancer is known to have metastasis via lymph vessels and lymph nodes. Sentinel lymph node biopsy is effective for determining the presence or absence of metastasis of breast cancer by examining the lymph nodes (sentinel lymph nodes) to which the lymph of cancer cells first reaches. In order to perform a biopsy, it is necessary to identify the location of the sentinel lymph nodes. Conventionally, the method of locating sentinel lymph nodes by using radioisotope and blue dye has mainly been used, in recent years, the method of using magnetic field has attracted attention. Magnetic nanoparticles are injected near the breast cancer. After flowing into the sentinel lymph nodes using the flow of lymph, the position of the sentinel lymph node is specified by detecting the magnetic nanoparticles from outside the body. Previous studies have reported using permanent magnets [1] and AC magnetic field, however the accuracy is not enough for patients with high BMI. Since pulsed magnetic field can generate a relatively high magnetic field as compared with them, highly accurate examination can be expected for patients with high BMI.

Resovist® (Fuji Film Co.) including superparamagnetic particles was used in this study. It is known that magnetization is saturated when the magnetic field of about 0.4 T is applied to the Resovist®. Induced electromotive forces of the same magnitude were obtained and canceled in blank measurement with two search coils as shown in Fig. 1. Magnetic field was applied to measure the magnetization signal of the Resovist® with one search coil, and the blank was measured with the other. The two induced electromotive forces were evaluated according to Eq. (1).

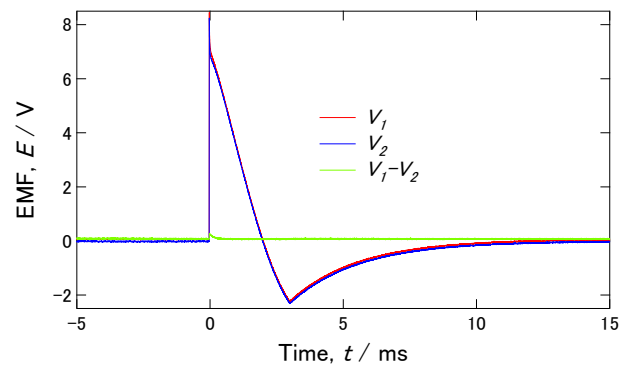


Fig. 1. Cancellllation of EMFs

$$B^* = -\frac{1}{NS} \int (V_{Resovist} - V_{blank}) dt, \quad (1)$$

We plan to improve the search coil to increase the detection accuracy.

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References: [1] Masaki Sekino *et al.*, Scientific Reports **8** (2018) 1195. [2] H. Mikihide *et al.*, The 66th JSAP Spring Meeting, 10p-M113-3.