P1-5-4-A 生体磁場センサ応用に向けたホイスラー合金電極 強磁性トンネル接合の作製
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Fabrication of Magnetic Tunnel Junctions with Full Heusler Alloy for Bio-Magnetic Field Sensor
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Magnetic tunnel junctions (MTJs) have great advantages for the magnetic field sensor applications. However, a significant improvement of tunnel magneto-resistance (TMR) ratio is needed to detect a small bio-magnetic field. In this study, we fabricated MTJs with half-metallic Co$_2$Fe$_{0.4}$Mn$_{0.6}$Si (CFMS) Heusler alloy which are expected to increase TMR ratio. The fabricated MTJs were annealed twice to achieve sensor-type TMR curves. Figure shows the 2nd annealing temperature dependence of TMR curves. In MTJ annealed at 200°C, TMR curve showed a linear resistance response, which is required for sensor applications. This work was supported by the S-Innovation program, Japan Science and Technology Agency (JST).

P1-5-5-A 生体磁場センサ応用に向けた強磁性トンネル接合の作製と評価
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Fabrication and Evaluation of Magnetic Tunnel Junctions for Bio-magnetic Field Sensor Applications
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Tunnel magneto-resistance (TMR) effect can be applied to magnetic field sensors because this effect is resistance change of magnetic tunnel junctions (MTJs) by external magnetic field. We have to develop the MTJs with a very high sensitivity (=TMR/2H$_k$, H$_k$: magnetic anisotropy field) above 100%/Oe to detect a small bio-magnetic field. In this work, MTJs using CoFeSiB electrode with a low H$_k$ were fabricated. A very high sensitivity of 115%/Oe was achieved by optimization of the CoFeSiB thickness. This sensitivity is the highest value among single MTJ devices and the MTJs with such a high sensitivity can be applied to bio-magnetic field sensor devices.

P1-5-6-A 生体磁場計測に向けた強磁性トンネル接合センサの作製とノイズ特性
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Fabrication and Noise Performance of Magnetic Tunnel Junctions for Detection of Bio-magnetic Field
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MTJ is a small size device, working in room temperature with low power consumption, and is expected to enable detection of bio-magnetic field without liquid He. For the purpose of practical realization of MTJ bio-magnetic sensor, this study evaluated the signal and noise with various MgO barrier thicknesses in MTJ to reduce 1/f noise in frequency domain. Figures show MgO thickness dependence of signal voltage, noise voltage and S/N ratio measured from 18 Hz, 120 nT$_{in}$ input signal. Both signal and noise voltage increased with increasing MgO thickness. From this relation of signal and noise, maximum 154 S/N ratio was acquired by 2.2 nm MgO thickness.