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Diamond-based magnetometer with dc sensitivity below 10 pT Hz^-1/2 for magnetoencephalography

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Abstract

Diamond-based magnetometer using negatively charged nitrogen-vacancy (NV) centers is one of favorable quantum sensors for biomedical applications such as magnetoencephalography (MEG) due to its robustness and good field sensitivity under an ambient condition. However, MEG requires a minimum detectable field on the order of picotesla, which has not been realized with a diamond-based magnetometer.

We develop a sensitive diamond-based magnetometer with a dc sensitivity below 10 pT/ √Hz toward MEG of a living rat. We found that the sensor is stable with the remarkable sensitivity for at least 200 minutes. The minimum detectable magnetic field was found to be 0.3 pT for a few thousand seconds of measurement. Therefore, our sensor is capable of detecting a repetitive biomagnetic field, for example, a stimulus-evoked field, with a strength of the order of 1 pT by accumulating the signals.

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