Micro NMR Coil for Liquid ^{3}He at Ultra Low Temperature

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NMR is a powerful technique to study nuclear spin dynamics of liquid/solid ^{3}He at ultra low temperature, such as texture profiles of superfluid ^{3}He, spin wave modes of liquid/solid ^{3}He. In order to investigate those forming and deforming spatiotemporal processes, however, we need to have higher spatiotemporal resolution without changing static magnetic fields. To achieve this goal, we are developing a CCD type imaging technique by using an array of micro NMR coils. A micro fabrication technique ensures homogeneous production of the array of the micro NMR coils. At RIKEN NanoScience Joint Laboratory, we made the micro NMR coils with the micro fabrication technique. The coil is about 100 μm long, 20 μm wide and deposited on a Si wafer. The coil wire is 3 μm wide, 200 nm thick and made of Au. For electrical insulation, SiO_2 layers are added below the wire. According to our calculation of the RF profile, this coil dimension enables us to observe spin dynamics 20 μm above the coil surface. The resistance through the micro coil is measured to be 17 ohm at room temperature and 4 ohm at 4.2 K. Due to this large remnant resistance, the Q value is estimated less than 1 at 100 MHz. In order to attain higher Q value, we opt to increase the wire thickness and to anneal the micro coils. Improvement will be also reported on the conference.