

Nitrogen-14 NQR using High- T_c RF SQUID

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We setup a Nitrogen-14 nuclear quadrupole resonance (NQR) detection system using a high- T_c rf SQUID as the sensor. To improve the sensitivity of high- T_c rf SQUID, normal metal transformer made of copper wire was used. The transformer operated in tuned mode by inserting a tunable capacitor in it. The Q value of the transformer was about 100. With the tuned transformer, the magnetic field sensitivity of a high- T_c rf SQUID was improved about 100 times from 50 fT/ $\sqrt{\text{Hz}}$ to about 0.5 fT/ $\sqrt{\text{Hz}}$ at the resonant frequency of 887 kHz. To reduce the influence of the strong excitation field, pulse-controlled rf switches and cross diodes were inserted in the transformer. Using this system, we successfully detected NQR at about 887 kHz for N-14 in p-nitrotoluene (PNT), and the signal-to-noise ratio was much improved than before. With Q-switch and SLSC (spin lock spin cycle) method, the very weak NQR signal of TNT at 841 kHz can also be successfully detected by the high- T_c rf SQUID.

keywords : SQUID, NQR