Knight shifts of ^{90}Nb, ^{93m}Mo, ^{96}Tc, and ^{101m}Rh in Nb using Brute-Force NMR-ON

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Brute-force NMR-ON (BF-NMRON) is an attractive method for mea magnetic interactions as very dilute impurities in cubic metals. R in BF-NMRON measuring for ^{90}NdCu and ^{101m}RhCu [1]. Hyperfine anomal ^{95}Tc-^{96}Tc and ^{106m}Ag - ^{101m}Ag were also determined using this method for the firs resonance frequency of BF-NMRON is given by $g\mu_N(1+K)(1-s)B_{ext}$, where g is the nucl factor, K is Knight shift factor, s is diamagnetic shielding corr B_{ext} is the external magnetic field. The Knight shift factor K involves import electronic structure of the metals. In order to study the Knight shift factors (Nd, Mo, Tc, and Rh) in Nb metals we performed BF-NMRON on ^{90}Nb, ^{93m}Mo, ^{96}Tc, and ^{101m}Rh in Nb. The g-factors of these isotopes are well known [3].

The radio-activities were recoil-implanted into pure Nb (99.9%) foils using (α, xn) and/or (α, xnp) reactions. The targets of 96Mo (enriched), Ru and Zr foils (or precipitated ...) were used. Alternating target and host foil stacks were irradiated with (α) from the AVF cyclotron. We had evaporated Cu on the backside of th soldering. The ^{3}He/^{4}He dilution refrigerator at Niigata University. The a of the foil was soft soldered to the copper cold finger and was co mK. The vertical external magnetic field B_{ext} was provided by a superconducting NbTi ... solenoid with 12T maximum field at 4.2 K. The γ-rays were detected with a Ge det (relative efficiency 70%) placed at 0(180) degree with respect to B_{ext}. The temperature of the samples was monitored using a ^{54}MnNi thermometer. The details of apparatus have been described in ref. 2.

The frequencies of the resonance centre obtained at B_{ext} = 11.92 T are ^{90}NbNb = 56.572(1) MHz, ^{93m}MoNb = 85.76(3) MHz, ^{96}TcNb = 66.997(5) MHz, ^{101m}RhNb = 111.01(1) MHz. With the calculated values of diamagnetic shielding correction factor [3] and the kno g-factors [3], the Knight shift factors were deduced: K(^{90}NbNb) = 0.84(10)%, K(^{93m}MoNb) = 0.84(10)%, K(^{96}TcNb) = 0.22(81)%, K(^{101m}RhNb) = 0.92(23)%. A systematic study of the Knight shift of 4d elements in extremely dilute alloy systems incl progress.

References

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