9.7 cm

$CuSiO_3$: A Candidate System for Purely Oxygen Antiferromagnet?

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Contrary to $CuGeO_3$ with its spin-Peierls transition, the isostructural $CuSiO_3$ system seems to be typical $S = 1/2$ antiferromagnet with long range AFM ordering below $T_N \approx 8.0$ K. NQR measurements in $CuSiO_3$ have revealed an unexpected puzzling picture evidencing the absence of the noticeable local hyperfine magnetic field on $^{63,65}Cu$ nuclei in AFM ordered state, and considerable charge redistribution as compared with $CuGeO_3$ counterpart system. The ^{63,65}Cu-NQR spectrum in $CuSiO_3$ system is likely to coincide with that in diamagnetic Cu_2O with the non-magnetic Cu^{1+} ionic state of copper. This coincidence may be accidental, however, small linewidth and weak temperature dependence both for NQR frequency and linewidth between 4.2 and 50 K without any anomaly at T_N are surprising. Moreover, the low-temperature behavior of T_1^{-1} in $CuSiO_3$ reveals the non-magnetic quadrupole mechanism of spin-lattice relaxation. Such a behavior of copper ions in $CuSiO_3$ points to a *nonmagnetic* Cu^{1+} copper valent state with the antiferromagnetically ordered *oxygen* surrounding. It means that the hole in the CuO_2 cell should be localized at oxygen, rather than at copper sites. We suggest a qualitative physical reasoning for the "*sp* hybridization induced oxygen hole stabilization effect" which is believed to be more pronounced in $CuSiO_3$ as compared with $CuGeO_3$.

13.4 cm

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