Physics and Chemistry of Minerals 2008 vol.35 N1, pages 37-48

Copper valence, structural separation and lattice dynamics in tennantite (fahlore): NMR, NQR and SQUID studies

Gainov R., Dooglav A., Pen'kov I., Mukhamedshin I., Savinkov A., Mozgova N.
Kazan Federal University, 420008, Kremlevskaya 18, Kazan, Russia

Abstract

Electronic and magnetic properties of tennantite subfamily of tetrahedrite-group minerals have been studied by copper nuclear quadrupole resonance (NQR), nuclear magnetic resonance (NMR) and SQUID magnetometry methods. The temperature dependences of copper NQR frequencies and line-width, nuclear spin-lattice relaxation rate T1 -1 and nuclear spin-echo decay rate T2 -1 in tennantite samples in the temperature range 4.2-210 K is evidence of the presence of field fluctuations caused by electronic spins hopping between copper CuS3 positions via S2 bridging atom. The analysis of copper NQR data at low temperatures points to the magnetic phase transition near 65 K. The magnetic susceptibility in the range 2-300 K shows a Curie-Weiss behavior, which is mainly determined by Fe2+ paramagnetic substituting ions. © Springer-Verlag 2007.

http://dx.doi.org/10.1007/s00269-007-0196-0

Keywords

Magnetic phase transition, NMR, NQR, SQUID, Tennantite, Tetrahedrite