

Conventional electron paramagnetic resonance of Mn²⁺ in synthetic hydroxyapatite at different concentrations of the doped manganese

Bakhteev S., Yusupov R., Gafurov M., Orlinskii S.
Kazan Federal University, 420008, Kremlevskaya 18, Kazan, Russia

Abstract

© 2018 Institute of Physics Publishing. All rights reserved. Powders of synthetic hydroxyapatite doped with Mn²⁺ ions in concentrations from 0.05 till 5 wt. % were investigated by conventional electron paramagnetic resonance (EPR). The parameters of the spin-Hamiltonian are derived. Partially resolved hyperfine structure in the magnetic fields corresponding to $g \approx 4.3$ and $g \approx 9.4$ is observed. The narrowing of the central peak with concentration is reported. A possibility to use the linewidth and intensity of the central peak for concentration measurements are discussed. The results could be used for the identification and qualification of Mn²⁺ in oil, mining and ore formations.

<http://dx.doi.org/10.1088/1755-1315/155/1/012006>

References

- [1] Omelon S, Ariganello M, Bonucci E, Grynepas M and Nanci A 2013 *Calcif. Tissue Int.* 93 382
- [2] Dong L, Zhu Z, Qiu Y and Zhao J 2016 *Front. Environ. Sci. Eng.* 10 28
- [3] Chlala D, Giraudon J M, Nuns N, Lancelot C, Vannier R N, Labaki M and Lamonier J F 2016 *Appl. Catal. B Environ.* 184 87
- [4] Khasanova N M, Gabdrakhmanov D T, Kayukova G P, Mikhaylova F N and Morozov V P 2017 *Magn. Reson. Solids* 19 17102
- [5] Low J 1957 *Phys. Rev.* 105 793
- [6] Gilinskaya L G and Sherbakova M Y 1971 *J. Struct. Chem.* 11 950
- [7] Gilinskaya L G and Sherbakova M Y 1975 *Isomorphous substitution and structural defects in apatites as found by EPR investigation (Novosibirsk: Publishing House "Nauka")* 62 (in Russian)
- [8] Mayer I, Diab H, Reinen D and Albrecht C 1993 *J. Mater. Sci.* 28 2428
- [9] Mayer I, Jacobsohn O, Niazov T, Werckmann J, Iliescu M, Richard-Plouet M, Burghaus O and Reinen D 2003 *Eur. J. Inorg. Chem.* 7 1445
- [10] Pan Y, Chen N, Weil J A and Nilges M J 2002 *Amer. Miner.* 87 1333
- [11] Pon-On W, Meejoo S and Tang I 2008 *Mater. Res. Bull.* 43 2137
- [12] Gafurov M, Biktagirov T, Mamin G, Klimashina E, Putlayev V, Kuznetsova L and Orlinskii S 2015 *Phys. Chem. Chem. Phys.* 17 20331
- [13] Gafurov M R, Biktagirov T B, Mamin G V, Shurtakova D V, Klimashina E S, Putlyaev V I and Orlinskii S B 2016 *Phys. Solid State* 58 469
- [14] Stich T A, Lahiri S, Yeagle G, Dicus M, Brynda M, Gunn A, Aznar C, DeRose V J and Britt R D 2007 *Appl. Magn. Reson.* 31 321
- [15] Chelyshev Y, Gafurov M and Ignatyev I 2016 *BioMed Res. Int.* 2016 3706280

- [16] Galukhin A V, Khelkhal M A, Gerasimov A V, Biktagirov T B, Gafurov M R, Rodionov A A and Orlinskii S B 2016 Energy Fuels 30 7731
- [17] Stoll S and Schweiger A 2006 J. Magn. Reson. 178 42
- [18] Klyava Y G 1988 EPR spectroscopy of disordered solids (Riga: Zinatne) 320 (in Russian)
- [19] Aminov L K, Gafurov M R, Korableva S L et al 2017 Phys. Solid State 59 564
- [20] Schreurs J W H 1978 Journ. Chem. Phys. 69 2151