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MAGNETIC ANISOTROPY OF Fe^{++} ION IN SIDERITE

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Cu^{++} and Fe^{++} are in $^2D_{5/2}$ and $^5D_4$ states respectively. According to Bethe (1929) in an electric field of cubic symmetry the *D*-states split into a doublet and a triplet; a rhombic field separates the components of the doublet and triplet by amounts much smaller than doublet and triplet separation but large compared to kT in the case of Cu^{+} and in Fe^{2+}. In case of Cu^{++} ion with positive cubic field coefficients the doublet is lowest while in Fe^{++} ion the triplet is lowest. Now this doublet is orbitally nonmagnetic. As a result the remains of the orbital moment should be larger in Fe^{++} ion than in Cu^{++} ion provided all other things are similar, and hence the magnetic anisotropy should be much more accentuated in Fe^{++} ion than in Cu^{++} ion. But a survey of the experimental results (Mookherji, 1945 and Krishnan and Mookherji 1938), ($\Delta K/\bar{K} = 41\%$ for Cu^{++} ion and 36% for Fe^{++} ion where ΔK is the average ionic anisotropy and $\bar{K}$ is the mean ionic susceptibility) shows that the reverse is the case. Apart from the explanation that the ratio of the orbital contribution to the spin contribution is of the same order in the two salts, there seems to be another reason for the above observation ; that is, in all the cupric salts studied so far the crystal field has very nearly tetragonal symmetry whereas the ferrous salts mentioned above most probably have a large departure from axial symmetry. Hence in Fe^{++} ion the orbital contribution is distributed in different direction, whereas in Cu^{++} ion it is confined along the symmetry axis. Therefore, the calculation of the magnetic anisotropy on the tetragonal assumption makes ΔK lower for Fe^{++} ion than for Cu^{++} ion. Hence if one could study a ferrous salt where the crystal field has an axial symmetry, the magnetic anisotropy of Fe^{++} ion might be found to be more than for Cu^{++}ion. This seems to be the case with the naturally occurring trigonal crystal of siderite (Wyckoff 1920) which contains 66% ferrous carbonate. We have, therefore, measured its magnetic anisotropy ($\Delta K/\bar{K}$) which is 47 % and more than for Cu^{++} ion. This is fairly satisfactory considering the fact that the internal symmetry of the paramagnetic unit in siderite may not be as good as in cupric salts.

Details of the measurements will be published later on.

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