

would increase the asymmetry between the pyrrole and pyridine nitrogens and thus increase the quadrupole splitting. The very extensive  $\pi$  system of the phthalocyanine ring allows for even greater delocalization of electrons from pyrrole nitrogen  $\pi$  orbitals, and it may be that it is this characteristic of the molecule, rather than the axial asymmetry of the pyridine ligands, which causes the large quadrupole splitting. Mössbauer experiments on iron(II) phthalocyanine with axially symmetric ligands (like CO) would show which of these two explanations for the large quadrupole splitting is correct.

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### Monodentate Ethylenediamine Complexes of Chromium(III)

Sir:

A recent paper by Childers, *et al.*,<sup>1</sup> reported the successful chromatographic isolation of the pentaquo(2-

aminoethylammonium)chromium(III) cation,  $\text{Cr}(\text{enH})-(\text{OH}_2)_5^{4+}$ , supposedly the first isolation of a complex of chromium(III) with a monodentate ethylenediamine ligand. A chromium(III) complex containing monodentate ethylenediamine may have been prepared more than half a century ago by the founder of coordination chemistry, Alfred Werner.

In an unpublished, but complete, typewritten manuscript dated June 1916, Werner described the preparation, properties, and constitution of a series of chromium complexes which apparently still remains unreported in the published literature. He formulated the parent compound as  $\text{H}[\text{Cr}(\text{en})_2\text{Cl}_4]$  and postulated a coordination number of 8 for chromium in this compound in analogy with its heavier congeners molybdenum and tungsten. We have been unable to prepare these compounds according to Werner's directions, but, on the basis of preliminary reflection spectra of Werner's samples (courtesy of Anorganisch-Chemisches Institut der Universität Zürich), Jørgensen<sup>2</sup> has tentatively identified the chloride of the series as  $1,2,3-[\text{Cr}(\text{en})-(\text{enH})\text{Cl}_3]\text{Cl}$ , a compound of hexacoordinated chromium containing both bidentate and monodentate ethylenediamine.

Werner's original paper has recently been published both in English<sup>3</sup> and German.<sup>4</sup> Small samples of Werner's compounds are available from the author.

(1) R. F. Childers, K. G. Vander Zyl, D. A. House, R. G. Hughes, and C. S. Garner, *Inorg. Chem.*, **7**, 749 (1968).

(2) C. K. Jørgensen in "Werner Centennial," G. B. Kauffman, Symposium Chairman, *Advances in Chemistry Series*, No. 62, American Chemical Society, Washington, D. C., 1967, pp 163, 164.

(3) G. B. Kauffman, *Chymia*, **12**, 217, 221 (1967).

(4) G. B. Kauffman, *Naturwissenschaften*, **54**, 573 (1967).

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