

this the value of  $\beta$  becomes  $1.138 \times 10^8$ . Considering (2) we get :

$$F_i = 2.1 \cdot 138 \times 10^8 \cdot 3.456 \times 10^{-12} (1-0.5) \cdot 0.5 = 1.97 \times 10^{-4} \text{ dyne}$$

for an Si—O bond in the above sense.

The strength of a silica fibre per cm.<sup>2</sup> is therefore  $1/v^{2/3}$  times  $F_i$ , that is,  $1.97 \times 10^{-4} \text{ dyne} / (22.7 \times 10^{-24})^{2/3} \text{ cm.}^2 = 2.42 \times 10^{11} \text{ dyne cm.}^{-2}$ , or 2,472 kp./mm.<sup>2</sup>. This calculated value is closest to the maximum experimental value, 2,460 kp./mm.<sup>2</sup>. Apart from the experimental errors we must consider that our calculation is based entirely on the assumption of Coulomb forces although the bond is partly covalent. It seems, therefore, that the errors due to different approximations in our calculation cancel themselves out.

The strength of asbestos fibres<sup>10</sup> and that of industrial glass fibres, although only of the order of 600–700 kp./mm.<sup>2</sup>, is much higher than the highest strength of thin metal wires, which is about 400 kp./mm.<sup>2</sup> (for thinnest tungsten wire).

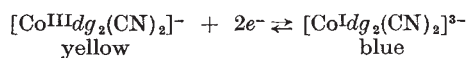
I. NÁRAY-SZABÓ  
J. LADIK

Central Research Institute for Chemistry  
of the Hungarian Academy of Sciences,  
Hungária krt. 114,  
Budapest, 14.

- <sup>1</sup> Griffith, A. A., *Phil. Trans. Roy. Soc., A*, **221**, 163 (1920).
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### New Univalent Cobalt Complexes of the [Co<sup>I</sup>dg<sub>2</sub>X<sub>2</sub>] Type

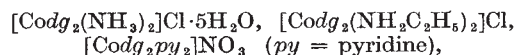
Dicyano - bis - dimethylglyoximato - cobaltate(III) complex, *trans*-K[Co<sup>III</sup>dg<sub>2</sub>(CN)<sub>2</sub>]·3/2 H<sub>2</sub>O (a new compound)<sup>1</sup> (dg = H<sub>3</sub>C·C(NO<sub>2</sub>H)·C(NO)·CH<sub>3</sub>), was found to be reduced at the dropping mercury electrode in one step to a univalent cobalt complex polarographically in 1 M potassium chloride supporting electrolyte. The following electrode process was ascertained.



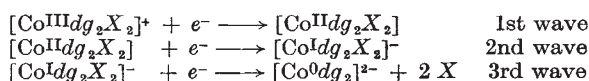
The resulting cobaltate(I) complex, K<sub>2</sub>[Co<sup>I</sup>dg<sub>2</sub>(CN)<sub>2</sub>], was isolated from the solution as a blue compound in an atmosphere of nitrogen.

The above electrode reaction is quasi-reversible polarographically. The half-wave potential of the cathodic wave did not agree with that of the anodic one.

On the other hand, *bis*-dimethylglyoximato-cobalt(III) complexes,



and so on, were found to undertake the stepwise reduction to a zero-valent cobalt complex irreversibly through cobaltate(I) complexes at the dropping-mercury electrode in the same supporting electrolyte. The main processes of the electrode reaction were concluded to be as follows :



where X denotes a neutral unidentate ligand, such as ammine, ethylamine, or pyridine.

On the contrary, as regards the other complexes of the type, [Co<sup>III</sup>dg<sub>2</sub>X<sub>2</sub>], the ligand of which, X, is a negative radical or ion, only the first wave was obtained in every case, mainly due to the hindrance of a large maximum wave (Table 1).

The diffusion current and the concentration of the complex are linearly related at the concentration in the range of 10<sup>-2</sup>–10<sup>-4</sup> M with respect to all the complexes.

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NOBUFUMI MAKI

Laboratory of Inorganic Chemistry,  
Osaka University,  
Kita-ku, Osaka.

<sup>1</sup> Maki, N., Fujita, J., and Tsuchida, R., *Bull. Chem. Soc. Japan* (in the press).

### A New Synthetic Route to Alkylphosphonous Dichlorides

It has recently been shown<sup>1</sup> that electron-donating solvents such as diethyl phthalate (DEP) provide a convenient route to the synthesis of alkylphosphonic dichlorides from the complex formed by combination of an alkyl halide, phosphorus trichloride, and aluminium chloride<sup>2</sup>. It has since been found that alkylphosphonous dichlorides may be syntheses

Table 1. HALF-WAVE POTENTIALS OF DIMETHYLGLYOXIMATO COBALT(III) COMPLEXES (25° C.)

Complex compound	$E_{1/2}$	$n$	Change of valence	$E_{1/2}$	$n$	Change of valence	$E_{1/2}$	$n$	Change of valence
[Co <sup>III</sup> dg(NH <sub>3</sub> ) <sub>2</sub> ]Cl·5H <sub>2</sub> O	-0.65	1	Co <sup>III</sup> → Co <sup>II</sup>	-1.04 <sub>5</sub>	1	Co <sup>II</sup> → Co <sup>I</sup>	about -1.27 <sub>2</sub>	1	Co <sup>I</sup> → Co <sup>0</sup>
[C}odg <sub>2</sub> (NH <sub>2</sub> C <sub>2</sub> H <sub>5</sub> ) <sub>2</sub> ]Cl	-0.66	1	Co <sup>III</sup> → Co <sup>II</sup>	-1.08	1	Co <sup>II</sup> → Co <sup>I</sup>		1	Co <sup>I</sup> → Co <sup>0</sup>
[C}odg <sub>2</sub> py <sub>2</sub> ]NO <sub>3</sub>	about -0.22*	1	Co <sup>III</sup> → Co <sup>II</sup>	-0.88	1	Co <sup>II</sup> → Co <sup>I</sup>	-1.18	1	Co <sup>I</sup> → Co <sup>0</sup>
K[Co <sup>III</sup> dg <sub>2</sub> (CN) <sub>2</sub> ]·3/2H <sub>2</sub> O				-1.10 <sub>7</sub>	2	Co <sup>III</sup> → Co <sup>I</sup>			
Na[Co <sup>III</sup> dg(NO <sub>2</sub> ) <sub>2</sub> ]	-0.35	1	Co <sup>III</sup> → Co <sup>II</sup>						
H[Co <sup>III</sup> dgCl <sub>2</sub> ]	+	1	Co <sup>III</sup> → Co <sup>II</sup>						
[Co <sup>III</sup> dg <sub>2</sub> (NO <sub>2</sub> )(OH <sub>2</sub> )]	-0.15 <sub>5</sub>	1	Co <sup>III</sup> → Co <sup>II</sup>						

Supporting electrolyte, 1 M potassium chloride; potential unit, volt versus the saturated calomel electrode; concentration of the complex, 0.005 M.

\* Small maximum wave (in the absence of maximum suppressor).