PROCEEDINGS OF THE YEREVAN STATE UNIVERSITY

Chemistry and Biology 2014, № 2, p. 36–38

Chemistry

MAGNETIC SUSCEPTIBILITIES AND MAGNETIC MOMENTS OF NITROGEN CONTAINING CHELATE

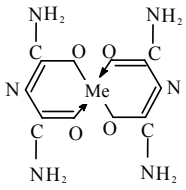
M. L. ERITSYAN, I. N. SIREKANYAN*, L. N. ERITSYAN

Armenian State Pedagogical University After Kh. Abovyan, Armenia

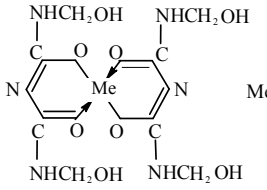
The magnetic susceptibilities and effective moments of complexes consisting of nitrogen containing ligands and Ni^{2+}, Co^{2+}, Cu^{2+} ions were studied. It was shown, that complexes listed bellow are paramagnetic and are subjected to the law of Curie–Weiss.

***Keywords*:** magnetic susceptibility, magnetic moment, chelate complex.

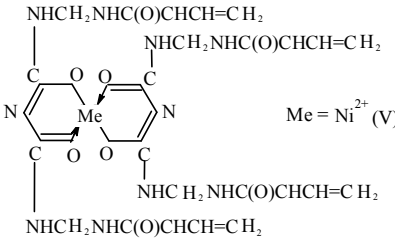
Introduction. We have synthesized the following nitrogen containing chelate complexes, which have been shown in previous works [1–3]:



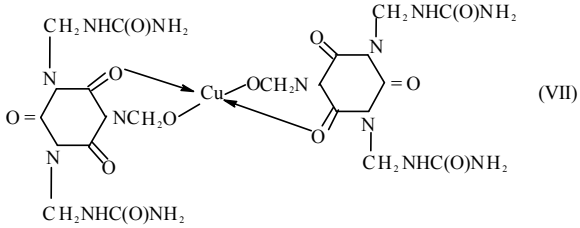
Me = Ni^{2+} (I), Co^{2+} (II)



Me = Ni^{2+} (III), Co^{2+} (IV)



Me = Ni^{2+} (V), Co^{2+} (VI)



(VII)

Scheme.

* E-mail: INS2912@rambler.ru

As it is highlighted in works above, the connections (I–VII) have applicable destination. They are good modificators and hardeners for the high-strenght and heat-resistant adhesives and lacquer coverings on the basis of epoxide, carbamide, fenolformaldehyde and other termoreactive resins and polymers. The chelate complex VII is a polyfunctional connection, because of its nonsaturated groups, so, it is recommended to use that compound as a linker for obtaining polymers with three-dimensional structure and high soaking ability.

To describe the properties of chemical connections, it is important to study their magnetic susceptibilities and effective magnetic moments.

The purpose of this work is to study the magnetic susceptibilities and magnetic moments of connections I–VII.

The results of above described investigations are given in Tab. 1 and 2.

Results and Discussions.

Table 1

Temperature dependence of specific and molar magnetic susceptibility of complexes I–VII ($\times 10^{-6}$)

Connections	Temperature measurement, *K*											
	77		100		150		200		240		299	
	$æ_g$	$æ_M$	$æ_g$	$æ_M$	$æ_g$	$æ_M$	$æ_g$	$æ_M$	$æ_g$	$æ_M$	$æ_g$	$æ_M$
I	31.5	8284.5	28.0	7374.5	20.5	5378.4	15.6	4355.3	14.6	3839.8	11.9	3121.8
II	35.6	9362.8	31.4	8247.7	23.1	6077.9	18.7	4920.7	16.5	4339.5	13.4	3524.2
III	39.8	15402.6	35.4	13707.5	25.8	1000.1	20.9	8096.0	18. 5	7140.2	15.0	5801.1
IV	40.7	15750.9	36.2	14017.1	26.4	10224.5	21.4	8277.9	18.9	7302.7	15.3	5932.7
V	48.9	16332.6	43.5	14535.7	31.8	10614.5	25.7	8583.8	22.7	7571.8	18.4	6152.3
VI	55.3	18456.8	49.0	16352.6	35.9	11993.9	29.0	9699.4	25.5	8517.0	20.6	6890.4
VII	25.1	16768.4	21.4	14907.8	16.3	10988.8	13.2	8811.1	11.6	7737.2	9.4	6256.5

Table 2

Temperature dependence of effective magnetic moments of complexes I–VII ($\times 10^{-6}$)

Connections	μ_{eff}					
	Temperature, *K*					
	77	100	150	200	240	299
I	2.27	2.44	2.55	2.62	2.72	2.74
II	2.41	2.58	2.71	2.82	3.15	2.91
III	3.08	3.32	3.48	3.61	3.71	3.73
IV	3.12	3.36	3.51	3.65	3.75	3.78
V	3.17	3.42	3.58	3.72	3.83	3.85
VI	3.38	3.62	3.81	3.94	4.05	4.08
VII	1.68	1.74	1.91	2.03	2.33	2.38

As it follows from Tab. 2, the coordinations of above listed ligands are mainly carried out on *p* spare orbital without any influence on unpaired electrons of Ni^{2+}, Co^{2+} and Cu^{2+} ions immersed exponents in *d* orbits.

Experimental Part. The synthesis and identification of compounds I–VII was carried out in accordance to [1–3]. For the definition of magnetic susceptibility

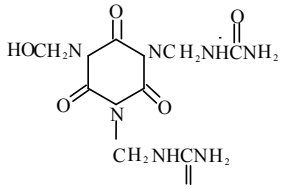
listed above complexes the method of Faradey was used [4]. The effective magnetic moments were defined according to equation

$$\mu_g = 2.84\ (æ_g\ M + \Delta æ_M (T \pm \theta))^{1/2},$$

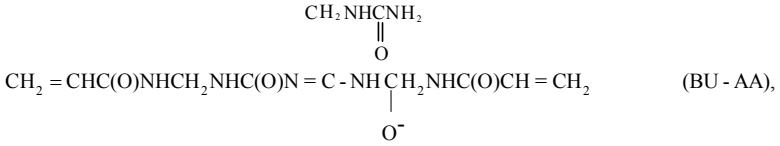
where $\Delta æ_M$ is diamagnetic correction; T is absolute temperature; θ is the value, which can be measured as temperature, θ was defined according to the equation

$$\theta = \frac{æ_{g,1}\ T_1 - æ_{g,2}\ T_2}{æ_{g,1} - æ_{g,2}},$$

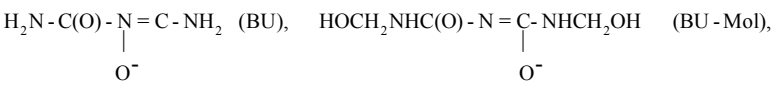
where $æ_{g,1}$ and $æ_{g,2}$ are specific magnetic susceptibilities at the temperatures T_1 and T_2 respectively. For the following ligands:



(IC–Mol),



(BU - AA),



(BU), (BU - Mol),

$\Delta æ_M$ was defined in accordance to Pascal's method [5]: $\Delta æ_{M,BU}=72{,}3\cdot10^{-6}$, $\Delta æ_{M,\text{BU-Mol}}=81{,}0\cdot10^{-6}$, $\Delta æ_{M,\text{BU-AA}}=85{,}6\cdot10^{-6}$, $\Delta æ_{M,\text{IC-Mol}}=91{,}2\cdot10^{-6}$. The molar magnetic susceptibility of $æ_M$ is defined by the equation $æ_M = æ_g M\cdot\Delta æ$, M is molar mass of the complexes.

It is necessary to shift that above presented complexes are paramagnetic and are subjected to the law of Curie–Weiss:

$$æ_g = \frac{C}{T+\theta},$$

where C is Curie's constant.

Received 26.02.2014

REFERENCES

1. **Sirekanyan I.N., Safaryan E.P., Gevorgyan S.S., Eritsyan M.L.** The Reactionable Derivatives of Biuret and Complexes on Its Basis. // Chemical Journal of Armenia, 2007, v. LX, № 3, p. 486–491 (in Russian).
2. **Sirekanyan I.N., Safaryan E.P., Gevorgyan S.S., Eritsyan M.L.** Modification of 1,3,5--Threemethylolisocianurate. // Proceedings of Engineering Academy of Armenia, 2006, v. 3, № 2, p. 303–307 (in Russian).
3. **Sirekanyan I.N., Engibaryan R.H., Khachatryan A.G., Eritsyan M.L.** Nonsaturated Rectionable Derivatives of Biuret. // Uchenie Zapiski EGU. Khimia i Biologia, 2009, № 2, p. 27–31 (in Russian).
4. Modern Chemistry of the Coordinated Connections (eds. D. Lewis and R.G. Wilkins). M.: Inostrannaya Literatura, 1963 (in Russian).
5. **Selwood P.** Magnetokhimia. M-L., 1964, p. 380 (in Russian).