

Multinuclear complexes of metal phthalocyanines and related macroheterocycles with transition metals and clusters

Faraonov Maksim A.,^{1*} Konarev Dmitry V.¹

¹ *Institute of Problems of Chemical Physics RAS, Academician Semenov avenue 1, 142432, Chernogolovka, Russia*

* E-mail: maksimfaraonov@yandex.ru

Metal phthalocyanines and related compounds are widely used to obtain photoactive and magnetic materials. One way to modify the structures and properties of such materials is the coordination of various fragments to the central metal atom of metal macrocycle. Coordination complexes attract much attention of researchers, because the introduction of an additional metal center into the phthalocyanine system leads to a change in its electronic structure. As a result, complexes with unique optical and magnetic properties and even synergy of such properties can be obtained.

In the present work, we have developed methods for the synthesis of coordination compounds of tin (II) phthalocyanine and related macrocycles with transition metals and clusters due to the formation of a tin–metal σ -bond [1, 2]. It has been established that such compounds can have different charge state of the macrocycle.

Of particular interest are formally neutral compounds in which charge transfer from the transition metal to the macrocycle is observed with the formation of a paramagnetic radical trianion ligand (for example, $\{\text{CpFe}^{\text{II}}(\text{CO})_2\text{Sn}^{\text{II}}(\text{Macrocycle}^{*3-})\}$). In such complexes, dense dimeric or one-dimensional packing of the macrocycles is observed, which leads to strong magnetic interactions in the systems (exchange interaction J up to - 180 K). These compounds are soluble even in nonpolar organic solvents and have intense absorption in the visible and near-IR regions due to the presence of the macroheterocycles.

Metal macroheterocycle in neutral or radical anion state can replace one or two carbonyl ligands in transition metal clusters ($\text{Ru}_3(\text{CO})_{12}$, $\text{Ir}_4(\text{CO})_{12}$ and others); paramagnetic clusters can also be formed in such reactions. Moreover, paramagnetic decamethylchromocene cations, Cp^*_2Cr^+ ($S = 3/2$), can act as counteranions.

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