MAGNETIC SUSCEPTIBILITIES AND OPTICAL REFLECTION SPECTRA OF 3d TRANSITION ELEMENTS COMPLEX ACETYLACETONATES

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The investigation of one series of 3d-transition complex acetylacetonates is performed:$TiO(acac)_2$,$VO(acac)_2$, $Cr(acac)_3$, $Mn(acac)_3$, $Mn(acac)_2$, $Fe(acac)_3$, $Fe(acac)_2$, $Co(acac)_3$, $Co(acac)_2$, $Ni(acac)_2$ and $Cu(acac)_2$ - in all eleven substances (Koch-Light and Merck). The investigation included:

- the determination of magnetic susceptibility by the Faraday method
- the recording of optical spectra by the method of reflection spectrophotometry in region from 360 to 1000 nm.

The aim of the cited investigation is the study of the influence of the crystal field, which arise from the oxygen atoms of acac - bidentate ligand ($-O_2C_5H_7$), on the 3d-transition metal ion and the comparison with the influence of other oxygen compounds (aquo-complexes, phosphates and soon). In this paper the first results of measurements done at the ambient temperature are presented.

The above mentioned acac-complex compounds have different crystal structures; the coordination polyhedra vary from octahedron for Fe^{3+}-ion, to tetragonal pyramid for VO^{2+}-ion and to square for Cu^{2+}-ion; complex compounds as for Fe^{3+} and VO^{2+} are monomers, while the $Ni(acac)_2$ and $Co(acac)_2$ are trimer and tetramer respectively|1,2|. The electronic structure and magnetic properties of the presently investigated complex compounds are reported in|3,4|.

In fig. 1. a series of the recorded optical spectra of the (acac)-complex compounds is given. Electronic transitions which correspond to 3d-ions in those spectra are identified by comparison with the optical spectry of hydrated sulphates that is, aquo-complex compounds, because

there one sure data about those compounds in literature|5|. The presence of the unidentified pics that probably correspond to the charge transfer spectra can be observed. All

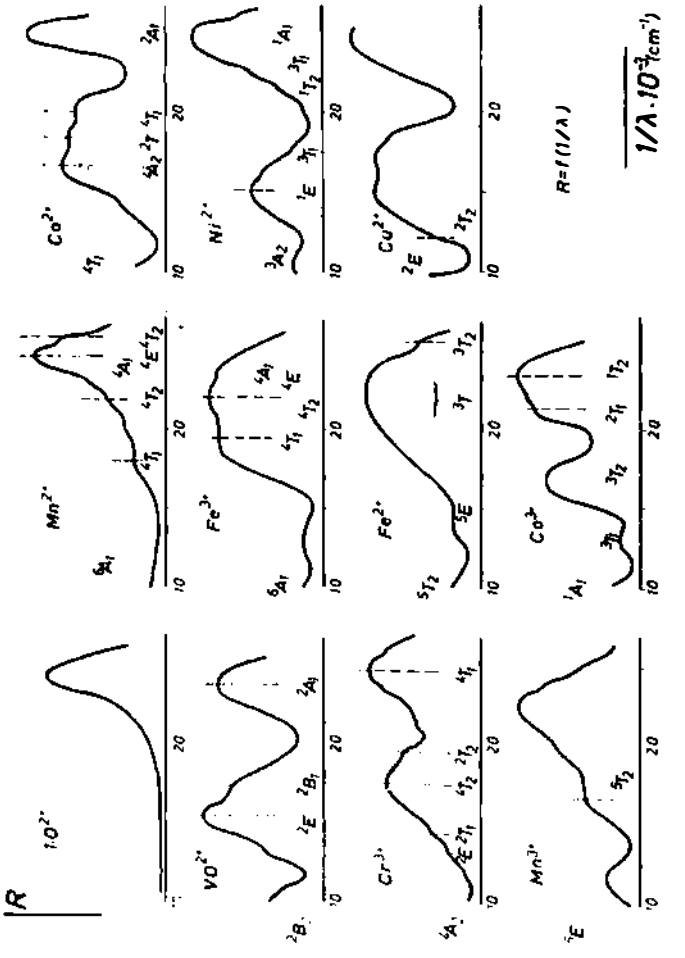

Fig. 1.

those spectra except for one, show that for the examined complex compounds 3d-ions are in weak crystal fields. It is interesting that it has already been established for several complex compounds of Co^{3+}|4|, that the spectra of $Co(acac)_3$ corresponds to strong crystal field for $3d^6$-ion.

The magnetic susceptibility measurements point out to the following. As was expected $TiO(acac)_2$ is diamagnetic. Measured value of the susceptibility is in agreement with the diamagnetic contribution of acac-ligand calculated according to|6|.Magnetic moments of 3d-ions, calculated on the basis of measured susceptibilities for VO^{2+}, Cr^{3+}, Cu^{3+}-compounds, correspond to the quenched orbital moments (for Fe^{3+}- and Mn^{2+}-orbital moment is zero);what corresponds to the crystal field theory|7|. For Fe^{2+},Co^{2+} and Ni^{2+}-ions magnetic moments are greater than the spin magnetic moments; for Fe^{2+}- and Co^{2+}- ions as is predicted by the crystal field theory, but not for the Ni^{2+}-ion. For the Ni^{2+}-ion, and probably for the other two ions too, the determined values for magnetic moments can be explained by the influence of intramolecular interaction|4|. Finally, $Co(acac)_3$ is diamagnetic what corresponds to the mentioned spectroscopic investigations; this result is in agreement with the magnetic investigations of some Co^{3+}-complex compounds|4|.

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