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SYNTHESIS, PHYSICO-CHEMICAL PROPERTIES COMPLEXES OF RUTHENIUM

Ruthenium forms many complex compounds with various ligands. The degree of oxidation of the central atom, which determines the physico-chemical properties of such compounds, varies widely (from -2 to +8). A special place in the chemistry of ruthenium is occupied by the degree of oxidation + 2, stabilized in nitrosocomplexes of various compositions. In aqueous solutions, octahedral complexes containing a stable linear Ru-N-O fragment with a total charge of +3 are the main state of nitrosoruthenium compounds. It is the high stability of the grouping $(RuNO)^{3+}$ determines the increased interest of researchers in these complexes. Among the proposed applications of ruthenium nitrosocomplexes, two areas are distinguished in which the applicability of this type of complexes is due to transformations of the nitrosogroup with the formation of metastable states or the release of a nitric oxide molecule. The participation of a free and coordinated NO particle in many physiological processes causes interest in the biological activity of ruthenium nitrosocomplexes.

Studies have shown that drugs based on them are less toxic and more effective than those currently used in medical practice [1].

Another actively developing application is the study of metastable states of ruthenium nitrosocomplexes, which are formed during a reversible photoinduced transition at low temperatures. This phenomenon provides new opportunities in the field of information storage, in the field of synthesis of hybrid materials whose physicochemical properties combine photoactivity with other physical properties, such as magnetism, special optical properties or conductivity. The synergism of such combinations in one crystal lattice can lead to the emergence of new physical properties and new directions in molecular electronics. The high stability and low toxicity of nitrosoruthenia complexes allows us to consider them as the most attractive precursors of new drugs and materials. These properties are especially characteristic of nitrozoamine complexes, which are already used to create nanopowders of metal alloys [2, 3], multifunctional photosensitive materials [4] and biologically active preparations [5]. The development of methods for obtaining new precursor complexes and fundamental information about their reactivity, structure and physico-chemical properties will allow us to successfully develop all these areas in the future.

With a large variety of ruthenium nitrosocomplexes available, the presence of metastable states for these complex compounds is determined only for a small number of substances. The most reliable method is X-ray diffraction analysis, but this method has some limitations. The geometrical parameters of the atoms and their nature are determined with good accuracy for substances with a high proportion of metastable state in the crystal: in the single crystal $[RuNO_{(py)4}Cl]$ $(PF_6)_2 \cdot H_2O$, 91% occupancy of MS1 is recorded, in the case of $[RuNO_{(py)2}(NO_2)_2OH] \cdot H_2O$, the proportion of Ru-ON it reaches 65% in the crystal, which is an irrefutable proof of the presence of metastable states in these samples. In addition to X-ray diffraction analysis, these compounds were studied using infrared spectroscopy. A more reliable evidence of the presence of a metastable state is the valence oscillation of the isonitrosogroup in the IR spectrum.

We synthesized 10 previously known ruthenium nitroso compounds and irradiated tablets with the substance with radiation with a wavelength of 443 nm. New absorption bands in the range from 1700 to 1800 cm^{-1} were recorded by us in the IR spectra of all 10 compounds studied. absorption bands are a key signal for detecting metastable states in nitrosocomplexes. Earlier in the literature it was noticed that the frequency of the valence oscillation of the nitrosogroup is determined by the nature of the complex compound. Quantitative determination of kinetic parameters characterizing the stability of metastable states is possible when using the method of differential scanning calorimetry to determine the heat flow from the sample in which the metastable state is transformed into a stable one. Such a transformation is accompanied by the release of energy, which is recorded by the device according to the difference in temperatures of the sample and the reference sample.

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СТРУКТУРА ЗАЩИТНОГО ПОКРЫТИЯ, СФОРМИРОВАННОГО НА ПОВЕРХНОСТИ ЛЕГИРОВАННЫХ РЕДКОЗЕМЕЛЬНЫМИ ЭЛЕМЕНТАМИ СПЛАВАХ МАГНИЯ МЕТОДОМ ПЛАЗМЕННО-ЭЛЕКТРОЛИТИЧЕСКОГО ОКСИДИРОВАНИЯ

В последние годы магниевые сплавы привлекают значительное внимание в связи с возможностью использования их в качестве ортопедических имплантатов [1]. Это связано с их уникальным сочетанием механических свойств и биосовместимости. Магниевые сплавы имеют оптимальное соотношение прочности и веса, что делает их альтернативой традиционным материалам для имплантатов, таким как титан и нержавеющая сталь. Необходимо отметить, что магний и его сплавы используются для изготовления биорезорбируемых имплантатов, т. е. происходит разрушение имплантата посредством клеточных и ферментативных реакций. Кроме того, было доказано, что магний способствует формированию новой костной ткани [2].

Однако существуют проблемы, препятствующие широкому использованию магниевых сплавов в качестве ортопедических имплантатов. Одной из основных проблем является высокая скорость коррозии магниевых сплавов в средах организма человека, что приводит к образованию гидроксида магния и газообразного водорода. В физиологической среде из-за присутствия высоких концентраций хлорид-ионов наряду с гидроксидом образуется хлорид магния, гидролиз которого приводит к локальному повышению pH в приповерхностной области и способствует увеличению скорости коррозии магниевых имплантатов [3].

Для решения проблемы быстрой коррозии магниевых сплавов в физиологической среде используют либо различные методы модифи-