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Abstract of doctoral thesis

Impregnated suspension copolymers for sorption of noble metals

(Impregnowane suspensyjne kopolimery do sorpcji metali szlachetnych)

In a view of improving quality of life and constantly developing modern technologies, the demand for noble metals is continually increasing. They are essential in manufacturing almost all of the electric equipment, without which humans' daily functioning is difficult to imagine. This need, due to limited natural resources, becomes difficult to be satisfied. The only way to cover this deficit is reaching out secondary resources. They in turn, due to reduced utilization of the metals such as gold, palladium and platinum, are containing fewer and fewer of these precious materials. The consequent increasing dispersion of the noble metals caused, that the traditional pyro- and hydrometallurgical processes become insufficient for efficient recovery thereof. This fact opens up a possibility of widespread application of the processes based on ion exchange.

The present doctoral thesis is an extension of research topics implemented in the Department of Polymer and Carbonaceous Materials of Wroclaw University of Science and Technology. It concerns the search for new polymeric materials revealing the ability to exchange ions, for sorption and recovery of noble metals such as gold, platinum and palladium from solutions in which they exist in trace amounts.

In the course of the research, I discovered a great potential for concentrating and recovery of noble metals, revealed by polymeric resins, modified using compounds derived from aliphatic and aromatic amines. Unfortunately, despite the high efficiency of these exchangers they are not able to be effectively utilized due to the lack of full availability of their ion-exchange groups, the introduction of which involves considerable costs. This phenomenon significantly limits the applicability of this type of materials, and therefore, all the advantages they bring with.

Accordingly, the present doctoral thesis provides a method for preparing of new polymeric anion exchange resins, characterized by properties unique for *core-shell* polymers. These materials are based on the copyrighted polymeric supports, modified using compounds derived from aliphatic and aromatic amines. In the course of the research I evaluated the ability of these polymers to the sorption and recovery of Au(III), Pt(IV) and Pd(II) from a solutions in HCl and aqua regia leachates of wasted electronic parts.

The developed method for the synthesis of a new type of anion exchange polymers resulted in obtaining materials revealing an overall availability of their functional groups. This directly reduces the amount of expensive reagents necessary for their synthesis. The new anion exchangers combine the advantages arising from the use of amino functional groups and those arising from the *core-shell* nature. This means that the designed materials reveal satisfactory ion exchange capacity, improved sorption kinetics, an outstanding selectivity towards the noble metals as well as the possibility of their recovery.

The works comprising this dissertation represent thematically and chronologically coherent series of scientific publications prepared and monitored by me as the corresponding author at every stage of rigorous reviews in the editorial offices of the journals form the *JCR* list. They contain a comprehensive description of the tests performed, the techniques employed as well as a thorough discussion of the results. Additionally, because of its form, I provided a concise guide, which contains a critical review of the presented scientific achievements.