

The aim of this project is to gain new insights into the phenomena occurring in laser-assisted electroless metallization when a new copper complex and infrared laser radiation are used to activate the surface of polymer coatings containing. An important step in the project is the synthesis of a new copper complex which is an active component of the coatings. Based on preliminary studies, it is expected that the new complex will be reduced to metallic copper under infrared laser radiation, and will have a good dispersion with a polymer coating.

The purpose of the project is also to determine the effects of infrared laser irradiation on the physical and chemical properties of the surface coating, especially surface catalytic properties that are required in the electroless metallization process due to the use of a new copper complex. Basic properties of coatings and deposited copper layers, which are important in assessing application potential (mainly in electronic and mechatronic devices) will be determined.

Realization of project objectives will require to follow these main research stages:

1. Chemical synthesis of new copper complex.
2. Determination of coatings composition (mainly the content of new copper complex).
3. Laser surface treatments of polymer coatings deposited on thermoplastic substrate (Nd:YAG and CO₂ lasers will be applied).
4. Electroless metallization of laser irradiated coatings.
5. Determination of the influence of irradiation conditions and coatings composition on catalytic, structural and mechanical properties of these coatings.

Realization of general project objective will proceed due to the following experimental scheme:

I). Determination of catalytic properties of coatings resulting from:

A) coating composition; It is assumed that a very important factor will be the type and percentage of the new copper complex.

B) laser irradiation conditions; In order to obtain the best catalytic properties of the coatings, the following radiation parameters will be selected: laser beam power, scanning speed, number passage of beam, frequency.

II). Determination of the quality of the electrolessly deposited copper layer; This assessment will be made primarily based on microscopic measurements, determining the structure and thickness of copper layers after a different time of metallization. In addition, spectroscopy and adhesion testing of copper-deposited layers will be carried out.

So far, few organometallic complexes have been tested as precursors for electroless metallization of laser-activated materials. Most of the work involved palladium complexes that are very expensive and use ultraviolet (excimer lasers) or visible range of laser radiation.

In this project it is proposed to use: (I) polymeric coatings containing new copper complex and (II) infrared laser radiation, which imparts additional element of novelty referring to the current state-of-the-art. It is expected that after modifications with infrared laser radiation, these coatings will become active and fully prepared for direct electroless metallization.

An important element of this project is also to determine effects of laser surface treatment on the reduction of copper complex to metallic copper, changes in chemical and physical structure, and on the quality of copper-deposited layers. It is planned to use near ($\lambda = 1064 \text{ nm}$) and far infrared ($\lambda = 10.6 \text{ }\mu\text{m}$) laser radiation. Examining the application potential of the new complex along with determining the appropriate parameters of laser modification may be an object of intellectual property and directly or indirectly contribute to the development of the Polish innovative economy.