NEW SOLVENT QUENCHING PRESSURE SENSITIVE PAINTS (SQ-PSP) FOR MAPPING PRESSURE DISTRIBUTION ON SURFACES

Maciej Pilch, Roman Popielarz, Joanna Ortyl

Faculty of Chemical Engineering and Technology, Laboratory of Photochemistry and Optical Spectroscopy, Cracow University of Technology, Cracow, Poland

In recent years, in the face of fast technology development, there is a growing need for new types of measurement systems for mapping state parameters and thermodynamic variables such as pressure and temperature on surfaces. Demand for modern **systems monitoring the pressure distribution on surfaces** is observed especially in industries such as the automotive, aerospace and construction industries. Designing modern machines and structures with an increasingly complex structure requires control of the distribution on their surfaces parameters such as pressure, which is dictated by both security considerations and the optimization of resource consumption. Modern measurement systems based on electronic point sensors are very expensive to use and in many cases do not give satisfactory results. In recent years, photochemical techniques for measuring pressure distributions based on **pressure sensitive paints (PSP)** have been of great interest. The mechanism of their operation is based on the phenomenon of **oxygen luminescence quenching**. Thanks to the use of pressure sensitive paints, it is possible to significantly improve the quality of results and reduce costs, but these solutions also have numerous disadvantages. Therefore, a search for a new pressure mapping technique using luminescent molecular sensors was undertaken.

As a main part of the work, an **apparatus for measuring the effect of pressure on emission characteristics of luminescent sensors** in polymeric coating materials has been designed and constructed. In the next stage of work, a series of SQ-PSP (ang. *Solvent Quenching Pressure Sensitive Paints*) type polymeric coating materials based on acrylic and methacrylic copolymers with toluene absorbed and labeled with luminescent probes were prepared. As a luminescent sensor, various new **lanthanide complexes** were used. The compositions were tested using the constructed equipment. The normalized luminescence intensity (I_{max}/I_{ref}) of the representative signal of these matrices was measured as a function of pressure. For most matrices, the obtained dependence of the (I_{max}/I_{ref}) parameter on pressure could be approximated by decreasing logarithmic functions. The maximum change of the (I_{max}/I_{ref}) parameter, for the pressure range from 30 to 400 kPa, in a closed, constant-volume system was 40%. Based on the results obtained, an application of the studied lanthanide complexes for the role of luminescent pressure sensors in SQ-PSP systems is proposed.