

DESCRIPTION FOR THE GENERAL PUBLIC (IN ENGLISH)

The experimental studies and the production of alloys based on lithium requires the use of a high purity protective atmosphere, with a very low concentration of nitrogen, oxygen, water vapour or carbon dioxide, due to their high reactivity with lithium. Therefore, the number of experimental data on the thermodynamics of systems with lithium is very limited and earlier studies of these systems are often inaccurate due to the technological limitations then in place. Hence the necessity of their verification and supplementation of the existing literature database. The new thermodynamic data for the proposed systems will be used in the future to develop phase diagrams (or their verification) necessary in the design and production of new materials and modelling of physicochemical properties, for example, of the surface tension and viscosity.

The subject of the research will be two- and three-component alloys based on lithium: Pd-Li, Pt-Li and Pt-Pb-Li, and Pd-Pb-Li for which there are no thermodynamic data in the literature. In connection with the above, the project will aim at pioneering thermodynamic studies for the proposed systems. The obtained results will be used to model physicochemical properties and assess the impact of lithium on the wettability of catalytic layers. Proposed measurements of thermodynamic properties of the liquid Pt-Pb-Li and Pd-Pb-Li solutions will enable the development of ternary interaction parameters that will allow determining the dependence of excess Gibbs energy as a function of temperature and concentration of components, which in turn will allow to determine, in the future, the phase equilibria these ternary systems.

To achieve the aim presented in this project the following research are proposed:

- a) Measurements of lithium activity in liquid Pt-Li and Pd-Li binary and liquid Pt-Pb-Li and Pd-Pb-Li ternary solutions by measuring electromotive forces of concentration cells.
- b) Calorimetric measurements of enthalpy of mixing of Pt-Li, Pd-Li and Pt-Pb-Li and Pd-Pb-Li liquid alloys.
- c) Determination of the equation describing the thermodynamic properties of liquid ternary solutions Pt-Pb-Li and Pd-Pb-Li with the Muggian model with ternary interaction parameters.
- d) Modeling the surface tension of liquid Pt-Li, Pd-Li binary and Pt-Pb-Li and Pd-Pb-Li ternary solutions.
- e) Measurements of wettability of platinum and palladium with lead and Li-Pt alloys by the spread method.
- f) Verification of the obtained results using real material and magnetohydrodynamic pump.

Obtained experimental values of enthalpy of mixing and lithium activity from measurements of electromotive forces will be introduced into the free ENTALL database and the results of surface tension modeling and wettability measurements for the SURDAT base of physicochemical properties of metal alloys. Both databases are available on the website of the Institute of Metallurgy and Materials Science of the Polish Academy of Sciences: www.imim.pl and are free of charges.