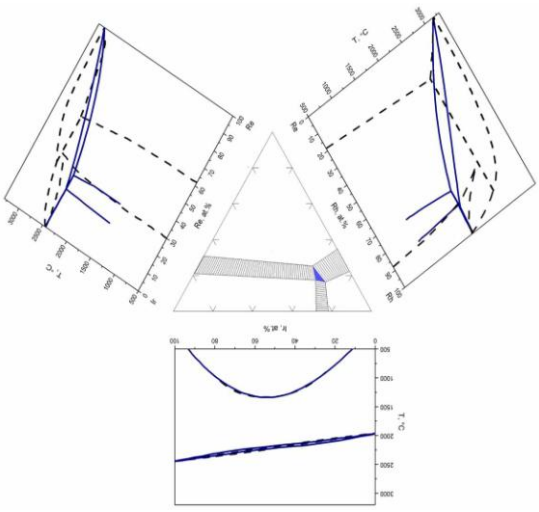
TERNARY PHASE DIAGRAMS OF PLATINUM GROUP METALS

K.V. Yusenko

Department of Chemistry, Center for Materials Science and Nanotechnology, University of Oslo, P.O. 1033 Blindern, 0315 Oslo, Norway, e-mail: kirill.yusenko@smn.uio.no

Alloys based on platinum group metals (PGM) are widely used as high-temperature materials for special applications. The systematic investigation and the construction of new materials are usually based on the analysis of phase diagrams with high dimensionality. Depending on the number of components, binary, ternary and multicomponent diagrams should be taken into account for a materials development. Ternary phase diagrams of PGM have been intensively investigated during the last 60 years. Nevertheless, only a few ternary phase diagrams are known in details in whole temperature and concentration regions [1]. Difficulties in the temperature and inert atmosphere control, a possible contamination of investigating samples, as well as a relatively slow equilibration limit the experimental construction of multicomponent phase diagrams for materials with high melting points.

It has been shown that several phase diagrams should be corrected and re-determinated to achieve the concordance between phase boundaries and reliable experimental data [2-4]. In the work presented, existing binary and ternary phase diagrams of PGM are critically analyzed and compared with recently obtained experimental data. Series of PGM solid solutions in a broad range of composition were recently prepared using a single-source precursor's strategy to improve miscibility gaps boundaries as well as *CALPHAD* (CALculation of PHAse Diagrams) based refinements were performed to construct realistic models for *hcp—fcc* and *hcp—hcp* phase diagrams. Obtained graphical data and thermodynamic database for mixing parameters in *liquidus* and *solidus* parts can be further used for an improvement of ternary phase diagrams while the ternary phase boundaries dependent on the binary mixing parameters. The corresponding binary and ternary mixing parameters can be used additively as the contribution of the binary mixing parameters into the Gibbs energy sum is higher than the contribution of the ternary part.



The figure shows the construction of isothermal section (2100 °C) of the Ir—Re—Rh ternary phase diagram using the thermodynamic database for binary Ir—Re, Ir—Rh and Re—Rh parts.

[1] Chunxiao H, Guanfang L. Phase Diagrams of Precious Metal Alloys and Structure Parameters of Precious Metal Compounds.— Beijjing.: Met. Ind. Press, 2010.— 724 P.; [2] Okamoto H., Massalski T.B. // J. Phase Equilibria.— 1994.— V. 15.— No. 5.— P. 500—521; [3] Yusenko K.V. // Platinum Metals Review.— 2011.— V. 54.— No. 3.— P. 188—194; [4] Yusenko K.V. // Platinum Metals Review.— 2013.— V. 57.— No. 1.— P. 57—65.