EUROPEAN SYNCHROTRON RADIATION FACILITY

INSTALLATION EUROPEENNE DE RAYONNEMENT SYNCHROTRON

Experiment Report Form

	Experiment title: High-pressure instability of hcp-structured Os—Pt	**Experiment number**: HC-3940
Beamline: ID15B	**Date of experiment**: from:03.11.2018 to:07.11.2018	**Date of report**: 12.08.2019
Shifts: 9	**Local contact(s)**: Dr. Michael Hanfland	*Received at ESRF:*

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Report:

We collected room temperature data for several incompressible platinum group alloys up to 45 GPa in Ne as pressure-transmitting media. We obtained precise parameters of the the equations of state for several fcc- and hcp-structured Ir, Rh, Pt, Pd and Ru binary alloys:

Composition (max. P)	V_0/Z, Å^3·atom^{-1} P = 1 bar)[b]	V_0/Z, Å^3·atom^{-1} According to Zen's rule	B_0, GPa / B_0'
fcc–$Ir_{0.50}Pt_{0.50}$ (up to 15 GPa)	14.60(1)	14.625	321(10) / 6.2(5)
fcc–$Pd_{0.50}Rh_{0.50}$ (up to 45 GPa)	14.18(2)	14.224	222(7) / 5.1(4)
fcc–$Pt_{0.33}Rh_{0.67}$ (up to 47 GPa)	14.210(3)	14.180	259(1) / 6.7(1)
fcc–$Ir_{0.67}Ru_{0.3}$ (up to 46 GPa)	14.050(1)	13.964	332(2) / 5.4(1)
hcp–$Ir_{0.25}Ru_{0.75}$ (up to 46 GPa)	13.773(1)	13.720	316(1) / 5.1(1)

Our study suggest regularities in compressibility parameters of refractory ultra-incompressible metals (see figure below). Nevertheless, *hcp*–$Ir_{0.25}Ru_{0.75}$ and *fcc*–$Ir_{0.67}Ru_{0.33}$ binary alloys have higher compressibility in comparison with pure metals.

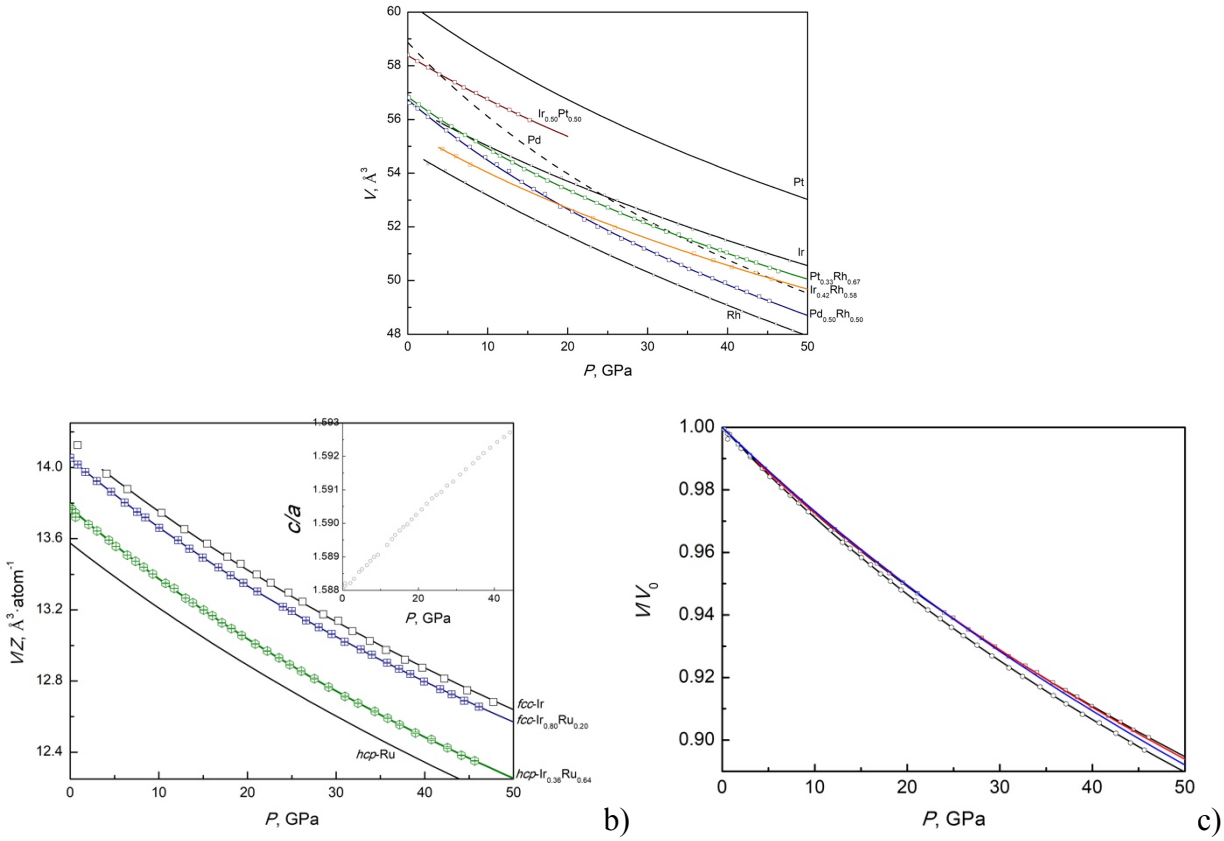

Figure. Room temperature pressure compressibility curves for fcc-structured alloys (a) as well as for *hcp*–$Ir_{0.25}Ru_{0.75}$ and *fcc*–$Ir_{0.67}Ru_{0.33}$ binary alloys (b and c) and pure metals in V/Z *vs. P* (*b*) and V/V_0 *vs. P* (*c)* scales (*inset* shows pressure dependence of *c*/*a* value for *hcp*–$Ir_{0.25}Ru_{0.75}$).

We are now drafting two publications where we are going to summarize all experimental data obtained:

1. Yusenko, Martynova, Khandarkhaeva, Bykov, Hanfland, Gromilov, Dubrovinsky (2019): High-pressure high-temperature properties of synthetic analogous of binary iridium–ruthenium and ternary iridium–osmium–ruthenium minerals prepared from single-source multimetallic precursors, J. Alloys Compounds, in preparation.
2. Yusenko, Khandarkhaeva, Bykov, Hanfland, Gromilov, Yusenko, Dubrovinsky (2019): Equations of state for fcc-structured refractory ultraincompressible alloys, J. Alloys Compounds, in preparation.