Report to APDIC, May 2024

Activities of Members of Ukrainian Phase Diagrams and Thermodynamics Commission, Ukraine

Compiled by:

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Short Information about the Meetings held in 2023

IX International Scientific and Technical Conference "Advanced technologies, materials and equipment in the foundry" was held from 25st to 27th September, 2023 in Kramatorsk.

The Conference was organized by Donbas State Engineering Academy (Kramatorsk, Ukraine).

Section 2. "Physico-chemical fundamentals of production of metals and alloys" worked as a part of the conference. The main topics of the Section 2 were:

- Fundamental principles of advanced materials science;
- Metallic materials and technologies of their production;
- Thermodynamics of liquid alloys;
- Phase equilibria and thermodynamic properties of phases;
- Oxide-based materials.

XV International Conference on Crystal Chemistry of Intermetallic Compounds (IMC-XV) was held from 25st to 27th September, 2023 in Lviv.

The Conference was organized by Ivan Franko National University of Lviv, Ministry of Education and Science of Ukraine, National Academy of Sciences of Ukraine and Ukrainian Crystallographic Committee.

The main topics of the Conference were:

Intermetallic and related compounds:

- Phase diagrams.

- Crystal structures.

- Physical properties.
- Crystal chemical features.
- Databases and software.

8th International Materials Science Conference "HighMatTech-2023" was held from 2nd to 6th October, 2023 in Kyiv.

The Conference was organized by Frantsevich Ukrainian Materials Research Society, Frantsevich Institute for Problems of Materials Science of NASU (FIPMS; Kyiv, Ukraine) and National Technical University of Ukraine "Igor Sikorsky Kyiv Polytechnic Institute".

The main topics of the Conference were:

- Metals and alloys.
- Ceramics and glasses.
- Low-dimensional and nano materials.
- Films and coatings.

IV All-Ukrainian Scientific and Technical Conference "Наука і металургія" ("Science and Metallurgy") was held from 14th to 16th November, 2023 in Dnipro.

The Conference was organized by Iron and Steel Institute of Z.I. Nekrasov of NASU and Ukrainian State University of Science and Technologies of the Ministry of Education and Science of Ukraine (Dnipro, Ukraine).

The main topics of the Conference were:

- Iron and steel metallurgy: technologies, innovations, quality;
- Electrometallurgy;
- Technologies of non-baking processing of cast iron and steel;
- Automation and modern methods of control of metallurgical processes and quality metallurgical products;
- Metallurgy and heat treatment of steel;
- Advanced technologies of metal processing by pressure;
- Modelling and optimization of technological processes;
- Ecological problems of ferrous metallurgy

On the APDIC annual meeting (June 30, 2023, Massachusetts Institute of Technology in Boston, USA) the Best Paper Award to the authors of the article judged to be the best publication in the field of phase equilibria and thermodynamics of the previous 2022 year was given to Kostyantyn Korniyenko, Konstantin Meleshevich, Anatoliy Samelyuk and Lyudmila Kriklya, the scientists of the Frantsevich Institute for Problems of Materials Science of NASU, and to Viktor Sobolev, the scientist of the Technical Centre of NASU, by article "Phase Equilibria in the Al–Ti–Cr System During Solidification" published in the *Journal of Phase Equilibria and Diffusion*, 2022, **43**(4), 427–447 (<u>https://doi.org/10.1007/s11669-022-00983-4</u>). According to APDIC's decision, the co-authors received a Winner's Certificate and the prize.

This is the second time our employees have been awarded a Best Paper Award. In 2012, the Best Paper Award 2011 was given to Anatolii Bondar and Tamara Velikanova, the scientists of the Frantsevich Institute for Problems of Materials Science of NASU, by article "Phase Equilibria in Binary and Ternary Systems with Chemical and Magnetic Ordering", published in the *Journal of Phase Equilibria and Diffusion*, 2011, **32**(4), 329–349 (<u>https://doi.org/10.1007/s11669-011-9910-1</u>). However, the Best Paper Award 2022 is special — all authors work in scientific institutions of Ukraine, the experimental research was completely carried out in Ukraine. This demonstrates the high potential of Ukrainian science and the ability of Ukrainian scientists to create world-class scientific and technical products in difficult conditions.

Two articles of Ukrainian scientists received the distinction of "Editor's Choice Article 2023" with open online access in the *Journal of Phase Equilibria and Diffusion*:

- L. Kriklya, K. Korniyenko, V. Petyukh, I. Tikhonova, A. Samelyuk, V. Sobolev, P. Levchenko. "Solidus Surface of the Hf–Rh–Ir System". *Journal of Phase Equilibria and Diffusion*, 44 (3) (2023), 394–407. DOI: 10.1007/s11669-023-01046-y.
- A. Storchak, V. Petyukh, V. Sobolev, I. Tikhonova, M. Bulanova. "Phase Equilibria in the Ti–Zr–Cu System". *Journal of Phase Equilibria and Diffusion*, 44 (5) (2023), 608–630. DOI: 10.1007/s11669-023-01064-w.

The Presidium of the National Academy of Sciences of Ukraine awarded prizes named after outstanding scientists of Ukraine based on the results of the 2023 competition held by branches of the National Academy of Sciences of Ukraine. Laureates of I.M. Frantsevich Award:

- Anatolii Bondar, Head of the Department of Physical Chemistry of Inorganic Materials, Frantsevich Institute for Problems of Materials Science of NASU, Doctor of Science, Professor;

- Julia Fartushna, Leading Researcher of the Department of Physical Chemistry of Inorganic Materials, Frantsevich Institute for Problems of Materials Science of NASU, Doctor of Science;

- Oksana Kornienko, Head of the Department of Functional Ceramics Based on Rare Earths, Frantsevich Institute for Problems of Materials Science of NASU, Doctor of Science

for the series of works "Phase diagrams of the metal and oxide systems as a basis for the creation of promising heat-resistant and heat-resistant materials".

Ukrainian Frantsevich Materials Research Society awarded prizes named after outstanding material scientists of Ukraine based on the results of the 2023 competition.

Laureate of V.V. Skorokhod Award — Tamara Velikanova, Chief Researcher of the Department of Physical Chemistry of Inorganic Materials, Frantsevich Institute for Problems of Materials Science of NASU, Doctor of Science, Professor — for an outstanding contribution to materials science during a long, intense and successful scientific activity, namely to the development of physico-chemical materials science in the direction of physico-chemical analysis of heterogeneous multicomponent metallic condensed systems as the basis for the development of new heat-resistant materials for structural and instrumental purposes for work in extreme operating conditions.

Laureate of O.R. Andrievska Award — Mikhail Turchanin, Vice-rector of the Donbass State Engineering Academy (Ministry of Education and Science of Ukraine, Kramatorsk), Doctor of Science, Professor — for the article: M. Turchanin, P. Agraval, L. Dreval, A. Vodopyanova, V. Korsun. "Mixing enthalpy of the Co–Ti–Hf liquid alloys and regularities of the function change in the row of the ternary (Co, Ni, Cu)–Ti–Hf glassforming melts. *Materials Today: Proceedings*, 62 (2022), 7681–7685. DOI: 10.1016/j.matpr.2022.03.130.

The Organizations and Investigators in the Field of Phase Diagrams, Thermodynamics and Crystal Structures in Ukraine Presented their Results in the 2024 year Report of Ukrainian Phase Diagrams and Thermodynamics Commission

Organization	Persons	Field of Interests
Frantsevich Institute for		
Problems of Materials Science		
(National Academy of	Team Leader	
Sciences of Ukraine, Kyiv)	Dr.Sc. A. Bondar	
Department of Physical		Alloy phase diagrams and
Chemistry of Inorganic	Dr.Sc. M. Bulanova	thermodynamics of the metallic
Materials	Dr.Sc. J. Fartushna	alloys
	Ph.D. M. Ivanov	
	Ph.D. K. Korniyenko	
	Ph.D. L. Kriklya	
	Ph.D. O. Myslyvchenko	
	A. Storchak	
Department of Functional Ceramics	Team Leader	Phase diagrams of the ceramic
Based on Rare Earths	Dr.Sc. O. Kornienko	systems based on rare earths
	Yu. Yurchenko	
	S. Yushkevych	
Donbas State Engineering Academy		
(Ministry of Education and Science		
of Ukraine, Kramatorsk)	Team Leader	Thermodynamics of phases and phase
Laboratory of Physico-chemical	Prof. Dr.Sc. M. Turchanin	diagrams
Properties of Metallic Liquid Alloys		
	Dr.Sc. P. Agraval	
	Ph.D. L. Dreval	
	Ph.D. G. Vodopyanova	
Taras Shevchenko National		
University of Kyiv		
(Ministry of Education and Science	Team Leader	
of Ukraine, Kyiv)	Prof. Dr.Sc. O. Roik	Structure and thermodynamics of
Department of Physical Chemistry		metallic alloys
	Dr.Sc. V. Sokol'skii	
	Ph.D. N. Usenko	
	Ph.D. N. Kotova	
	Ph.D. N. Golovataya	
	Ph.D. O.Yakovenko	

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СТ	Computational Thermodynamics	Julia Fartushna <juliefart81@gmail.com></juliefart81@gmail.com>				
ICE	Published Data	Oksana Kornienko <kornienkooksana@ukr.net></kornienkooksana@ukr.net>				
Х	work in progress	Kostyantyn Korniyenko <korniyenkok@ukr.net></korniyenkok@ukr.net>				
F	finalized in the reporting period	Lyudmila Kriklya <lyudmila20sk@gmail.com></lyudmila20sk@gmail.com>				
Р	planned for the current year	Oleksandr Myslyvchenko <zvyagina47@gmail.com></zvyagina47@gmail.com>				
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		Anastasiia Storchak <asyasf@bigmir.net></asyasf@bigmir.net>				
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		Natalia Usenko <nataliya_usenko@knu.ua></nataliya_usenko@knu.ua>				
		Ganna Vodopyanova <annasolyanova.as@gmail.com></annasolyanova.as@gmail.com>				

System	EP	ET	CA	СТ	ICE	Contributor	Comment
Ag–Eu–Sn		F				[24lva]	Ph.D. M. Ivanov, Ph.D. N. Usenko
							enthalpies of mixing of
							liquid alloys
Al-Fe-V	F					[23Far1]	Dr.Sc. J. Fartushna
							Dr.Sc. M. Bulanova
							phase diagram
Al-Ni-Sn	F		F			[23Yak]	Prof. Dr.Sc. O. Roik,
							high-temperature X-ray
							diffraction
C-Cr-Fe-Ni-Ti	F					[23Bag]	Ph.D. O. Myslyvchenko
							phase composition
	_					10 () (]	of high-entropy cermets
Ce-La-O-Yb	F					[24Yus]	Dr.Sc. O. Kornienko
							S. YUShkevich
							CeO_2 -La ₂ O ₃ -TD ₂ O ₃
Co-Er	F					[23Ear2]	Dr Sc. Eartushna
							Dr.Sc. M. Bulanova
							phase diagram
Co-Er-Fe	F					[23Far2]	Dr.Sc. J. Fartushna
	-					[]	Dr.Sc. M. Bulanova
							phase diagram
Co-Sn-Zr	F					[23Bul]	Dr.Sc. M. Bulanova
							Dr.Sc. J. Fartushna
							phase diagram
Cu-Fe-Hf-Ni				F		[24Agr]	Dr.Sc P. Agraval
							phase diagram of
							metastable phase
							transformations with
							participation of
				-			supercooled liquid alloys
Cu-Fe-HI-INI-TI				F		[24Agr]	Dr.Sc P. Agraval
							metastable phase
							transformations with
							participation of
							supercooled liquid allovs
Cu-Fe-Hf-Ti				F		[24Aar]	Dr.Sc P. Agraval
						[=9.]	phase diagram of
							metastable phase
							transformations with
							participation of
							supercooled liquid alloys
Cu-Fe-Ni-Ti				F		[24Agr]	Dr.Sc P. Agraval
							phase diagram of
							metastable phase
							transformations with
							participation of
	1						supercooled liquid alloys

System	EP	ET	CA	СТ	ICE	Contributor	Comment
Cu-Fe-Ni-Ti-Zr				F		[24Agr]	Dr.Sc P. Agraval
							phase diagram of
							metastable phase
							transformations with
							participation of
							supercooled liquid alloys
Cu-Fe-Ni-Zr				F		[24Agr]	Dr.Sc P. Agraval
							phase diagram of
							metastable phase
							transformations with
							participation of
							supercooled liquid alloys
Cu-Fe-Ti-Zr				F		[24Agr]	Dr.Sc P. Agraval
							phase diagram of
							metastable phase
							transformations with
							participation of
							supercooled liquid allovs
Cu-Hf-Ni-Ti				F		[23Vod]	Ph.D G. Vodopvanova
							phase diagram of
						[24Agr]	metastable phase
							transformations with
							participation of
							supercooled liquid alloys
Cu-Hf-Ni-Ti-Zr				F		[24Aar]	Dr.Sc P. Agraval
				-		[phase diagram of
							metastable phase
							transformations with
							participation of
							supercooled liquid alloys
Cu-Hf-Ni-Zr				F		[24Aar]	Dr.Sc P. Agraval
						1 31	phase diagram of
							metastable phase
							transformations with
							participation of
							supercooled liquid alloys
Cu-Hf-Ti				F		[23Tur]	Prof. Dr.Sc. M. Turchanin
							liquidus, solidus,
							isothermal and
							temperature-composition
							sections, phase diagram
							of metastable phase
							transformations with
							participation of
							supercooled liquid alloys
Cu-Ni-Ti-Zr				F		[24Aar]	Dr.Sc P. Agraval
							phase diagram of
							metastable phase
							transformations with
							participation of
							supercooled liquid alloys

System	EP	ET	CA	СТ	ICE	Contributor	Comment
Cu-Ti-Zr	F					[23Sto]	Dr.Sc. M. Bulanova A. Storchak
							phase diagram
Er-Fe	F					[23Far2]	Dr.Sc. J. Fartushna
							Dr.Sc. M. Bulanova
							phase diagram
Eu-Hf-O-Zr	F					[23Yur2]	Dr.Sc. O. Kornienko
							Yu. Yurchenko
							S. Yushkevich
							isothermal section of the
							ZrO ₂ -HfO ₂ -Eu ₂ O ₃ system
							at 1100°C
Fe-Hf-Ni-Ti				F		[24Agr]	Dr.Sc P. Agraval
							phase diagram of
							metastable phase
							transformations with
							participation of
							supercooled liquid alloys
Fe-Ni-Li-Zr				F		[24Agr]	Dr.Sc P. Agraval
							Phase diagram of
							metastable phase
							transformations with
							participation of
						10017 1	supercooled liquid alloys
Hī-Ir-Rn						[23Kri]	Ph.D. K. Korniyenko
							Ph.D. L. Krikiya
							pnase diagram
	-					[00](-1]	
HT-NO-O-Zr						[23K0r]	Dr.Sc. U. Kornienko
						[23Yur1]	
							5. YUShkevich
							the ZrO HEO NG O
							terperu phase diagram at
							1100 1500 and 1700 °C
Mo Nh Ti	E					[22Muc]	Ph.D. O. Myshyschopko
						[ZJIVIYS]	phase transformations in
							the quenched
							1 192.51 ND 51 VIO 2.5 all UY

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