

Proceedings of the 13th Conference on Liquid and Amorphous Metals (LAM13) (Ekaterinburg, Russia, 8–14 July 2007)

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2008 J. Phys.: Condens. Matter 20 110301

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PREFACE

Proceedings of the 13th Conference on Liquid and Amorphous Metals (LAM13) (Ekaterinburg, Russia, 8–14 July 2007)

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The most recent developments in the field of liquid and amorphous metals and alloys are regularly updated through two complementary international conferences: the liquid and amorphous metals conference (LAM) and the rapidly quenched materials (RQ) conference. The first series of conferences started as LM1 in 1966 at Brookhaven for the basic understanding of liquid metals. The subsequent LM conferences were held in Tokyo (1972) and Bristol (1976). The conference was renewed in Grenoble (1980) as a LAM conference including amorphous metals and continued in Los Angeles (1983), Garmisch-Partenkirchen (1986), Kyoto (1989), Vienna (1992), Chicago (1995), Dortmund (1998), Yokohama (2001) and Metz (2004). The conferences are mainly devoted to liquid and amorphous metals and alloys. However, communications on some non-metallic systems such as semiconductors, quasicrystals etc, are also accepted. The conference tradition strongly encourages participation from junior researchers and graduate students. The 13th conference of the LAM series was organized in Ekaterinburg, Russia, by the Institute of Metallurgy of the Ural Branch of the Russian Academy of Sciences (IMet UB RAS) and the Ural State Pedagogical University (USPU), and held from 8–14 July 2007 under the chairmanship of Professors Pjotr Popel (USPU) and Boris Gelchinskii (IMet UB RAS). Two hundred and forty two active participants and about 60 guest participants from 20 countries attended the conference. There were no parallel sessions and all oral reports were separated into three groups: invited talks (40 min), full-scale oral reports (25 min), and brief oral reports (15 min). The program included ten sessions, ranging from purely theoretical subjects to the technological application of molten and amorphous alloys.

The following sessions took place:

- A: Electronic structure and transport, magnetic properties;
- B: Phase transitions;
- C: Structure;
- D: Atomic dynamics and transport;
- E: Thermodynamics;
- F: Modelling, simulation;
- G: Surface and interface;
- H: Mechanical properties and new materials;
- I: Quasicrystals;
- J: Industrial applications.

The largest sessions were E, C, D and F with 53, 47, 43 and 40 reports, respectively. Posters were exhibited during the first (sessions A–E) or last (sessions F–J) three days of the conference.

As usual, each oral session started with an invited talk. In accordance with contemporary tendencies the first invited talk of M Yao (Kyoto University) was devoted to interrelations between liquid metal studies and nanoscience.

He pointed out that the physics of disordered matter, especially liquid metals, has provided nanoscience with basic ideas and theoretical tools such as *ab initio* molecular dynamics (MD) simulation.

K Tamura (Kyoto University) reported experimental investigation results of expanded liquid rubidium, showing that observed structural features are originated from the instability of low-density electron gas. Modern theory has predicted that interacting electron gas suffers negative compressibility and the static dielectric function (DF) becomes negative when electron density is sufficiently reduced. Negative DF is of special interest when considering the possibility of new types of superconductors.

In the next invited lecture, M I Mendeleev and J R Morris (USA) described how MD simulations were performed to study phase transformations in supercooled liquid Al. The authors found that the widely used EAM potential for Al enables vitrification for cooling rates achievable in classical MD simulation, while other Al potentials enable crystallization under the same conditions. The reason for this difference was discussed, as well as features of vitrification in the EA Al.

P Häussler (Chemnitz University) spoke about fundamental structure-forming processes in liquid and amorphous materials. He proposed the resonance model as an autonomous missing link between the microscopic description of atoms/molecules of Schrödinger's equation, and crystals, where global concepts such as planar resonances exist and Bloch's theorem is applied.

D Holland-Moritz (Institut für Materialphysik, Köln) presented the first results of the quasielastic neutron scattering experiments on electromagnetically levitated metallic melts. The studies were indicative of Arrhenius behavior of the diffusion constants over the whole temperature regime investigated, ranging from temperatures above the melting temperature up to the metastable regime of an undercooled liquid.

L Son (USPU) discussed the existing analytical theories of liquid–liquid phase transitions that have been assumed for a wide variety of liquids, but are poorly understood analytically. The application of these theories to liquid metal systems was also demonstrated.

An approach to the study of dynamics and kinetics of cavitation in stretched liquid metals by the classical MD method was presented in the talk of G E Norman (Institute for High Temperatures, Moscow). Both quantitative and qualitative disagreements with the classic theory of homogeneous nucleation were found. Analytic extensions of MD results beyond the space and temporal limits accessible for the MD method were also discussed.

G Wilde (University of Muenster) spoke about the experimental investigation into the impact of interface properties and, more specifically, of interface morphology in matrix-encased metallic nanoparticles on macroscopic properties, such as melting transition by a combination of microscopic, microanalytical and calorimetric measurements. The results were discussed with respect to the underlying mechanisms that lead to size dependent phase equilibria.

In the invited talk of V Keryvin (University of Rennes) the indentation ability was proposed as a probe for pressure sensitivity in metallic glasses. The main conclusion was that the indentation test provides a good means to study the elasto-plastic behavior of these materials as well as being a relevant tool to subject metallic glasses to multiaxial loadings.

The influence of changes in local ordering of precursor melt on the formation of the amorphous state and subsequent crystallization was the subject of a report presented by P Švec (Institute of Physics, Bratislava). The effect was shown for a rapidly quenched Fe–Mo–B system with addition of Cu and substitution of Fe by Co prepared under varying conditions of planar flow casting and using master alloys with specific melt treatment.

Approximately 320 abstracts were received and 180 manuscripts were finally submitted for publication. Papers from invited lectures and full-scale oral reports are published in *Journal of Physics: Condensed Matter* for this special issue. All papers from brief oral reports and posters were collected for an issue of *Journal of Physics: Conference Series*. All were edited by staff from Ekaterinburg.

It was decided during the joint meeting of both the International Advisory Board and International Program Committee that the next conference in the LAM series, LAM14, will be arranged by the groups of A Di Cicco (Camerino University) and T Scopigno (University of Rome 'La Sapienza'), and will take place in Rome, Italy, in 2010.

It is no easy task to outline new scientific tendencies in the field of liquid and amorphous alloys just after the LAM conference. It takes one or two years to estimate the significance of the event. Only one conclusion is obvious: the LAM13 conference has opened a door between the global scientific community and Russian scientists, who have special expertise in the field but could not actively participate at the LAM conferences before because of the economic situation in Russia. We are grateful to the Advisory and Program Committees of the LAM12 conference in Metz and especially to Dr Monique Calvo-Dahlborg for the opportunity to manage such an event in Russia.

In addition we would like to give our sincere thanks to:

- the authorities of the Ural Branch of the Russian Academy of Sciences and the Ural State Pedagogical University who did their best to help us with all our problems, especially to Boris Igoshev and Nikolay Vatolin;
- all the sponsors who supported the conference: the Russian Foundation for Basic Research, the Ural Mining and Metallurgical Company headed by Andrey Kozicyn, the Open Joint Stock Company 'Uralsvjazinform' (Alexey Ufimkin), the A A Baikov Institute of Metallurgy and Materials Science, RAS (July Kovneristii), the Institute for Physics and Power Engineering (Alexandre Ephanov), the Nuclear Power Plant 'Beloyarskaya' (Nikolay Oshkanov), the South Ural State University (German Vjatkin), Ural Technical Institute of Communications and Informatics (Evgeny Subbotin), Physical – Technical Institute UB RAS (Vladimir Lad'yanov), Metallurgical Department of the Ural State Technical University (Victor Shimov), Academy of Sciences of Chechen Republic (Raikom Dadashev) and NETZSCH-Gerätebau GmbH;
- the invited lecturers who immediately answered positively to the invitation and contributed to the high level of success of LAM13;
- the colleagues who acted as chairmen in the various sessions;
- Graham Douglas and Richard Palmer who kindly answered our queries and tried to satisfy our requirements;
- the seniors of the LAM series who could not participate at the 13th conference but helped us to manage it in the best way, namely J Dupuy, M Silbert, F Sommer, W C Pilgrim, W Freyland, K Lu, J Brmejo and F Hensel.

We dedicate the LAM13 conference to the 80 year jubilee of Professor Nikolay Vatolin who is one of the leaders of Russian investigation in the field of liquid and amorphous metals, and who managed 12 similar conferences in our country. One of us (PP) commemorates his father, Professor Stanislav Popel, who was a known specialist in high temperature capillarity and sadly left us six months before the event.

