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Lecture at Aarhus University
Department of Chemistry
Host: Prof. Dr. Shuai Wei

Exploration of fast time scales in metallic glasses and reactive metallic multilayers by chip calorimetry

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Understanding the nature of transitions between the glassy, liquid and crystalline states is a major challenge in physics as well as in materials science. With the emergence of advanced fast calorimetry, based on a chip-technology, we can nowadays access shorter and shorter time scales and thus experimentally measure the thermophysical properties of materials far from equilibrium. In this talk, we build on established and new work that our group has performed with this technique at ultra-short time scale for the study of many material characteristics. Selected topics may include: TTT-diagrams near the nose for crystallization¹, study of the undercooled liquid and glass formation from the melt in metallic glass-forming systems^{2,3,4}, hierarchical physical aging in bulk metallic glasses⁵, as well as studies of the diffusion and reaction kinetics in reactive nanocrystalline multilayered thin films for more than 5 orders of magnitude of heating rates^{6,7}.

¹ M. Frey et al., Determining and modelling a complete time-temperature-transformation diagram for a Pt-based metallic glass former through combination of conventional and fast scanning calorimetry, *Scripta Materialia* 215 (2022) 114710. DOI: 10.1016/j.scriptamat.2022.114710.

² X. Monnier, D. Cangialosi, B. Ruta, R. Busch, I. Gallino, Vitrification decoupling from α -relaxation in a metallic glass *Science Advances* 6, eaay1454 (2020). DOI: 10.1126/sciadv.aay1454

³ V. Di Lisio, I. Gallino, et al., Size-dependent vitrification in metallic glasses, *Nature Communication* 14/1 (2023) 4698. DOI: 10.1038/s41467-023-40417-4

⁴ W. Ma, J. Gebauer, A.K. Czerny, M. Rahimi Chegeni, I. Gallino, R. Busch, H. J. Seifert, Thermodynamic assessment of the sulfur and the nickel-sulfur systems, *CALPHAD* 89 (2025) 102821 DOI: 10.1016/j.calphad.2025.102821

⁵ I. Gallino, et al., Hierarchical aging pathways and reversible fragile-to-strong transition upon annealing of a metallic glass former, *Acta Materialia* 144 (2018) 400-410. DOI: 10.1016/j.actamat.2017.10.060.

⁶ A. Wang, I. Gallino, et al., Ultrafast formation of single phase B2 AlCoCrFeNi high entropy alloy films by reactive Ni/Al multilayers as heat source, *Materials & Design* 206 (2021) 109790. DOI: 10.1016/j.matdes.2021.109790

⁷ S.S. Riegler et al., Nanocalorimetry of Nanoscaled Ni/Al Multilayer Films: On the Methodology to Determine Reaction Kinetics for Highly Reactive Films, *Adv. Eng. Mater.* (2024) 2302279. DOI: 10.1002/adem.202302279

Short BIO

Isabella Gallino was educated and conducted research in Italy in the USA and in Germany.

- **Laurea in Chemistry**
1997 - University of Turin (Italy)
Thesis: Reactive Ni/Al multilayers
- **Ph.D. in Materials Science and Engineering**
2004 - Oregon State University (USA)
Dissertation: Inert anodes for the (green) electrolysis of aluminum
- **Habilitation - Metallic Materials**
2023 - Saarland University, Germany
Habilitation: Physical metallurgy of bulk metallic glass-forming liquids

After the Ph.D. she was appointed as

- **Lecturer** at Oregon State University (USA)
- **Assistant Professor** at Oregon State University (USA)
- **Principal Scientist** within the Chair of Metallic Materials at Saarland University (Germany)

In January 2024, she joined the **Technical University of Berlin as Full Professor (W3)** leading the Chair of Metallic Materials and the Research Center for Extrusion.

She has more than 20 years of research experience in **physical metallurgy**. Her research interests include both technical and fundamental science aspects, such as:

- the development of innovative metal processing techniques,
- discovery of new alloy compositions for commercial applications,
- studies of thermodynamic properties of stable and metastable phases,
- kinetics of phase transformations,
- phase diagrams determination,
- kinetics of high-temperature oxidation and corrosion,
- microstructural and structural analyses, including synchrotron-based techniques.

She has published about 100 technical articles and one book on the physical properties of bulk metallic glass-forming liquids and reactive multilayers.

[Isabella Gallino - Google Scholar](https://scholar.google.com/citations?hl=en&tzom=-120&user=44K09ykAAAAJ): <https://scholar.google.com/citations?hl=en&tzom=-120&user=44K09ykAAAAJ>