

Curriculum Vitae

Professor Dr. Ralf Busch



Date of Birth: April 6, 1963

German, married, 1 child

work:

Universität des Saarlandes
Lehrstuhl für Metallische Werkstoffe
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Research Interests

Broad interest in physical metallurgy, including thermodynamics and kinetics of metastable phase formation, metallic glasses, nanocrystals, composites, interface reactions, biocompatibility, nucleation and phase separation.

Education

University of Göttingen, Göttingen. Germany 1989-1992; Ph.D. Physics

Thesis (Metalphysics): "Analytical Field Ion Microscopy of the Reaction in Zr-Co Double Layers"

University of Göttingen, Göttingen. Germany 1987-1988; Diploma Physics

Thesis (Metalphysics): "Thermodynamical Description of Phase Transformations of Metastable NbNi - and NbCo - Alloys".

University of Göttingen, Göttingen. Germany 1983-1988; Student Physics.

Technical Skills

Atom probe field ion microscopy, transmission- and scanning electron microscopy, differential scanning calorimetry, X-ray diffraction, rheology. Rapid solidification and thin film

preparation techniques, casting and composite processing. Calculation-of-Phase-Diagram (CALPHAD) method.

Research Experience

Chair Professor (W3), 2005 – present

Lehrstuhl für metallische Werkstoffe, Fachrichtung 8.4, Saarland University, Saarbrücken, Germany.

Thermophysical properties of bulk metallic glass forming alloys, metallic biomaterials.

Associate Professor (with tenure), 2004-present

Department of Mechanical Engineering, Oregon State University, Corvallis, Oregon, USA

Thermophysical properties of bulk metallic glass forming alloys.

Assistant Professor, 1999-2004

Department of Mechanical Engineering, Oregon State University, Corvallis, Oregon, USA

Thermophysical properties of bulk metallic glass forming alloys.

Research Fellow (with Professor W.L. Johnson). 1993-1996, Senior Research Fellow 1996-1999

Materials Science Department, California Institute of Technology, Pasadena, California, USA

Thermophysical properties of bulk metallic glass forming alloys: specific heat capacity, emissivity, viscosity and glass transition; microstructure upon crystallization, solid state reactions in multicomponent systems and metallic glass matrix composites.

Postdoctoral Associate (with Professor P. Haasen). 1992-1993

Institut für Metallphysik, University of Göttingen, Göttingen, Germany

Determined microstructure and decomposition behavior of highly supersaturated f.c.c. Cu-Co and Cu-Fe solid solutions by AP/FIM, TEM, XRD and CALPHAD calculations.

Ph.D.thesis research (with Professor P. Haasen). 1989-1992

Institut für Metallphysik, University of Göttingen, Göttingen, Germany

AP/FIM studies of the early stages of the solid state amorphization reaction in Zr-Co bilayers

Diploma thesis research (with Dr. R. Bormann). 1987-1988

Institut für Metallphysik, University of Göttingen, Göttingen, Germany

Characterization of crystallization behavior of rapidly quenched Nb-Ni alloys by XRD and DSC. Modeling of the thermodynamic functions of the alloy including the amorphous state using the CALPHAD method.

Teaching experience

Instructor and course development of following courses in Saarbrücken (2005 - present):

Mechanical Properties of Materials (in German)

Thermodynamics and Kinetics of Materials (in German)

Amorphous materials (in English)

Instructor and course development of following courses in Oregon [in English (1999-2005)]:

Introduction to Materials Science (Undergraduate Level)
Mechanical Properties of Materials (Undergraduate Level)
Thermodynamics of Materials (Graduate Level)
Solidification (Graduate Level)
Amorphous Materials (Graduate Level)

Advisor of graduate students (7 master and 4 PhD), 1999-2005

Oregon State University

Advisor of graduate students (6 PhD), 1994-1999

California Institute of Technology

Teaching Assistant, Physics for Medical Students, Physical Metallurgy, 1987-1993

University of Göttingen

Selected recent publications (out of 102) [more than 3700 citations (“Hirsch-index”):34]

Glass transition with decreasing correlation length during cooling of $Fe_{50}Co_{50}$ superlattice and strong liquids

S. Wei, I. Gallino, **R. Busch**, and C.A. Angell, *Nature-Physics* **7**, 178 (2011)

Effect of free volume changes and residual stresses on the fatigue and fracture behavior of a Zr-Ti-Ni-Cu-Be bulk metallic glass.

M. E. Launey and J. J. Kruzic, **R. Busch**, *Acta Mater.* **56**, 500 (2008)

Enthalpy relaxation and its relation to the thermodynamics and crystallization of the $Zr_{58.5}Cu_{15.6}Ni_{12.8}Al_{10.3}Nb_{2.8}$ bulk metallic glass-forming alloy.

Gallino, M. B. Shah and **R. Busch**, *Acta Mater.* **55**, 1367 (2007)

Processing of copper fiber-reinforced $Zr_{41}Ti_{13.8}Cu_{12.5}Ni_{10.0}Be_{22.5}$ bulk metallic glass composites.

P. Wadhwa, J. Heinrich and **R. Busch**, *Scripta Materialia* **56**, 73 (2007).

On the fragility of Nb-Ni-based and Zr – based bulk metallic glasses.

L. Shadowspeaker and **R. Busch**, *Appl. Phys. Lett.* **85**, 2508 (2004).

“Processing of carbon fiber reinforced $Zr_{41}Ti_{14}Cu_{12}Ni_{10}Be_{23}$ bulk metallic glass composites.”

C.P. Kim, **R. Busch**, A. Masuhr, H. Choi-Yim, and W.L. Johnson, *Appl. Phys. Lett.* **97**, 1456 (2001).

“Transition from nucleation controlled to growth controlled crystallization in $Pd_{43}Ni_{10}Cu_{27}P_{20}$ melts.”

J. Schroers, Y.Wu, and **R. Busch**, W.L. Johnson, *Acta Mater.* **49**, 2773 (2001).

“Thermophysical Properties of Bulk Metallic Glass Forming Liquids.” **R. Busch**, *JOM* **52** (7), 39 (2000)

.

“ Diffusion mechanisms in metallic deeply supercooled liquids and glasses.” X. P. Tang, U Geyer, **R. Busch**, W.L. Johnson, and Y. Wu, *Nature* **402**, 160 (1999).

“Microstructure development during rapid solidification of highly supersaturated Cu-Co alloys.”

R. Busch, F. Gärtner, C. Borchers, P. Haasen and R. Bormann, *Acta metall.mater.* **43**, 3467 (1995).

“Decomposition and primary crystallization in undercooled $Zr_{41.2}Ti_{13.8}Cu_{12.5}Ni_{10.0}Be_{22.5}$ melts.”

R. Busch, S. Schneider, A. Peker, and W.L. Johnson, *Appl. Phys. Lett.* **67**, 1544 (1995).

Fellowships and awards

Feodor Lynen Research Fellow of the Alexander von Humboldt Foundation, 1993-1996.

Professional societies

Materials Research Society, Member (1994 – present).

The Minerals, Metals and Materials Society, Member (1996 – present).

German Physical Society, Member (1988 – present).

Journal of Metastable and Nanocrystalline Materials, Associate Editor (1999 – present).

Materials Research Society Fall Meeting, Boston, 2003, Symposium lead organizer of the Symposium on “Amorphous and Nanocrystalline Metals”,

Recent reviewer

Acta Materialia, *Applied Physics Letters*, *Journal of Applied Physics*, *Journal of Materials Research*, *Metallurgical and Materials Transactions*, *Nature*, *Philosophical Magazine A*, *Physical Review B*, *Physica B*, *Science*, *Scripta Materialia*.

Conference organizer and proceedings editor

MRS Fall 2003, lead organizer of “Symposium on amorphous and nanocrystalline metals”

MRS Fall 2007, lead organizer of “Symposium on Bulk Metallic Glasses”

Funding

AiF (Arbeitsgemeinschaft industrieller Forschungsvereinigungen e.V.): Herstellungs- und Anwendungsmöglichkeiten massiver metallischer Gläser auf Edelmetallbasis“, 1.1.11-31.12.12, **€173.950**

ZIM-AiF: „Thermoplastisches Formen Metallischer Massivgläser“ 1.1.11-31.6.13, **€173.216**

ZIM-AiF: „Entwicklung neuer Druckköpfe zur Herstellung von Microarrays auf Basis neuer hochfester Drucknadeln“ 1.11.2010- 31.7.2012, **€170.824**

KoWi2 (Landesprogramm Saarland): „Innovation im Uhrwerksbau durch Integration Metallischer Massivgläser“ 1.10.10-31.3.12, **€77.850**

PRO INNO II (AiF): „Mikroguss Metallischer Massivgläser“ 1.11.2007-30.6.2010, **€113.122**

EU: “ATLANTIS – EU-US Cooperation Programme in Higher Education and vocation Training – Transatlantic Degree Consortia Projects”, 1.10.2007 – 30.9.2011, **€408.000**

DFG-Großgeräte der Länder: Simultane TG-DTA/DSC-Apparatur, 11.6.2007, **€131.000**

“Blutverträglichkeit von Titanbasiswerkstoffen und deren Legierungselementen zur Anwendung als Dauerimplantate“, DFG Normalverfahren, 15 Juli 2007 – 15 Juli 2009“, **€164,100**

“Antibakterielle Funktionalisierung von Werkstoffoberflächen für orthopädische Implantate“, DFG Normalverfahren, 1. März 2007 – 28 Februar 2009, **€106,000**

“Rheologie massivglasbildender Metallschmelzen“, DFG Normalverfahren, 1. März 2007 – 28 Februar 2009, **€106,000**

“Thermogravimetric and Differential Thermal Analyzer” OSU – Research Equipment Reserves Fund 2004, **\$40,410**

“Processing of Mg-based alloys with low glass transition temperature“, Northrop Grumman Space Technology, \$5,000, October 1, 2003 – March 31, 2004.

“Dynamic Mechanical Analyzer“ OSU – Research Equipment Reserves Fund 2003, **\$52,087**.

“Turbomolecular pump“ OSU – Research Equipment Reserves Fund 2002, **\$18,800**.

“Thermodynamics and kinetics of deeply supercooled multicomponent metallic glass forming melts”, National Science Foundation, **\$370,000**, July 15, 2002 – July 14, 2006.

“Development of new inert alloy anode plates for a new aluminum reduction process“ Oregon Metals Initiative – Northwest Aluminum Company, **\$100,000**, July 1 2002 – June 30, 2003 (Co – PI with M. E. Kassner).

“Isomet 1000 Precision Saw” OSU – Research Equipment Reserves Fund 2002, **\$5,035**.

“Development of new inert alloy anode plates for a new aluminum reduction process“ Oregon Metals Initiative – Northwest Aluminum Company, **\$100,000**, July 1 2001 – June 30, 2002 (Co – PI with M. E. Kassner).

“Rheological Properties of Structural Amorphous Metals“, DefenseAdvanced Research Project Agency, **\$289,875**, May 1, 2001 – April 30, 2004

“Differential Scanning Calorimeter“, OSU – Kelley Family Funds 2001, **\$47,600**.

“Development of new inert alloy anode plates for a new aluminum reduction process“ Oregon Metals Initiative – Northwest Aluminum Company, **\$100,000**, July 1 2000 – June 30, 2001 (Co – PI with M. E. Kassner).

“Infiltration System for Metallic Glass Matrix Composites“ – Research Equipment Reserves Fund 2000, **\$20,000**.