

# Curriculum Vitae

**Professor Dr. Ralf Busch**



Date of Birth: April 6, 1963

Nationality: German

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 88) [more than 2200 citations (“Hirsch-index”:28)]**

*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 und **R. Busch**, *Acta Mater.* **55**, 1367 (2007)

*Thermodynamics, kinetics, and crystallization of  $Pt_{57.3}Cu_{14.6}Ni_{5.3}P_{22.8}$  bulk metallic glass.*

B. Legg, J. Schroers und **R. Busch**, *Acta Mater.* **55**, 1109 (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 und **R. Busch**, *Scripta Materialia* **56**, 73 (2007).

*Influence of structural relaxation on the fatigue behavior of a  $Zr_{41.2}Ti_{13.8}Cu_{12.5}Ni_{10.0}Be_{22.5}$  bulk amorphous alloy.*

M.E Launey, **R. Busch**, and J.J. Kruzic, *Scripta Materialia* **54**, 483 (2006).

*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”

### **Funding**

“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**.