

Dierk Raabe

SHORT BIO

Dierk Raabe studied music (4 Semesters) at Konservatorium Wuppertal (Germany), and metallurgy and metal physics (summa cum laude) at RWTH Aachen (Germany). After his doctorate 1992 (summa cum laude) and habilitation 1997 at RWTH Aachen he received a Heisenberg fellowship by the German Research Foundation and worked at Carnegie Mellon University (USA) and at the National High Magnetic Field Laboratory in Tallahassee (USA). He joined Max Planck Society as a director in Düsseldorf at the Max Planck Institut für Eisenforschung (Iron Research; now: MPI für Nachhaltige Materialien, Max Planck Institute for Sustainable Materials) in 1999. His main research interest today is to make industrial production of materials more sustainable, focusing on basic research where the leverage for CO₂ emission mitigation and lower energy consumption is particularly large in hard to abate industry sectors. His specific interests are in sustainable metals (specifically 'green' steel and other transition metals such as Nickel and Aluminium), recycling-oriented material design, hydrogen, sustainable manufacturing and metal combustion. He received the Gottfried Wilhelm Leibniz Award and two ERC Advanced Grants. He is professor at RWTH Aachen (Germany) and at KU Leuven (Belgium). He is a Doctor honoris Causa at the Norwegian Technical University Trondheim.

LONG BIO

General information

Name (if applicable name at birth):	Raabe
First name:	Dierk
Academic title:	Prof. Dr.-Ing. Habil. Dr. h.c.
Work address:	Max Planck Institute for Sustainable Materials Max-Planck-Str. 1, 40237 Düsseldorf, Germany
E-mail address:	d.raabe@mpie.de
Current position and status:	Managing Director, Professor (RWTH Aachen, KU Leuven)

University training and degrees

1983 - 1984	Study of Music, Konservatorium Rheinland, Institut Wuppertal
1984 - 1989	Study of Physical Metallurgy and Metal Physics, RWTH Aachen, Diploma degree („Dipl.-Ing.“), Diploma thesis at Institute for Physical Metallurgy and Metal Physics, RWTH Aachen, supervised by Prof. Dr. K. Lücke, summa cum laude

Advanced academic qualifications

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| 1992 | Doctoral thesis on "Textures of BCC transition metals " at Institute for Physical Metallurgy and Metal Physics, RWTH Aachen, supervised by Prof. Dr. K. Lücke, summa cum laude |
| 1997 | Habilitation, venia legendi for the fields Physical Metallurgy and Metal Physics, RWTH Aachen, Titel of Habilitation thesis: "Microstructure simulation in materials science - A review of modern approaches to the numerical simulation of materials with special emphasis on crystal plasticity and integrated methods" |

Postgraduate professional career

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| 1999 - today | Director, Max-Planck-Institut für Eisenforschung, Düsseldorf, Germany
Professor (APL), Physical Metallurgy and Metal Physics, RWTH Aachen, Germany |
| 1997 - 1999 | Postdoctoral researcher, Dept. Materials Science & Engineering, Carnegie Mellon University, USA and at the National High Magnetic Field Laboratory in Tallahassee, USA |
| 1992 - 1997 | Research assistant, group leader, Institute for Physical Metallurgy and Metal Physics, RWTH Aachen, Germany |

Supervision of Researchers in Early Career Phases (last 10 years)

> 55 postdocs (including host for >32 Alexander-von-Humboldt fellows); 35 PhD students; 16 Master Students, all at the PI's host institution, Max-Planck Institut Düsseldorf (Ph.D. exams at RWTH Aachen and RU Bochum); >25 co-workers obtained Professorship positions as next career steps during the past 10 years (Assistant, Associated, Full) in the US, Europe, Asia (including MIT, RWTH Aachen, KU Leuven, Xian University, Tohoku Univ., etc.)

Community services and scientific board memberships

- Member and Senator of the German National Academy Leopoldina
- Member North-Rhine-Westfaelian Academy of Sciences
- Member German Academy of Technical Sciences acatech
- Chair of the Gordon Research Conference on Physical Metallurgy, USA (2019)
- Senator of Helmholtz Association of German Research Centres (HGF) (2017-2022)
- Member, Expert Committee for the German 'Excellence Initiative and Excellence Strategy', serving 2 times: 2013, 2019
- Chairman of the Board of Governors (Hochschulrat) of RWTH Aachen University, Aachen, Germany (2012-2017)
- Member, Advisory Council of Science and Humanities of the German Government (Wissenschaftsrat) (2010-2016)
- Vice Chair of SFB 761 'Steel ab initio' (2007-2019)

Awards (selected)

- Gottfried Wilhelm Leibniz Award (DFG, 2004)

- 2 ERC Advanced Grants (2012, 2022)
- Acta Materialia Gold Medal (2022)
- Doctor Honoris Causa, Norwegian Technical University Trondheim (2022)
- 3 Best - Paper Awards (Best paper award of the Journal International Journal of Materials Research for the paper: A novel roll-bonding methodology for the cross-scale analysis of phase properties and interactions in multiphase structural materials. International Journal of Materials Research 106 (2015) 3-14; Best Paper Award for the paper "Autonomous Filling of Grain-Boundary Cavities during Creep Loading in Fe-Mo Alloys." in Metallurgical and Materials Transactions; best paper in steel research "Investigation of the orientation dependence of recovery in low-carbon steel by use of single orientation determination" steel research 66 (1995) No.5, p. 222/29)
- Masing Award (German Society for Materials Science DGM, 1997)
- Heisenberg Scholarship (German Research Foundation DFG, 1997)
- Materials Science and Technology Award by the Federation of European Materials Science Societies FEMS (2001)
- Weinberg Lecture Award, University of British Columbia (2011)
- DGM Award (Award of the German Society for Materials Science, 2011)
- Honorary Professor, Katholieke Universiteit Leuven, Belgium (2014)
- Werner Koester Award
- ASM Henry Marion Howe Medal
- Bauerman Lecture Award of Imperial College, London (2019)
- Seidman Lecture Award of Tel Aviv University (2018)
- TMS Light Metals Award (Aluminium Alloys) (2019)
- Kelly Lecture, University of Cambridge (2021), 100th anniversary year lecture of the Department of Materials Science & Metallurgy

Selected Publications (last 5 years)

1. Raabe, D., The Materials Science behind Sustainable Metals and Alloys. Chem. Rev. (2023), 123 (5), 2436–2608.
2. Sun, B., Lu, W., Gault, B., Ding, R., Makineni, S. K., Wan, D., Wu, C.-H. H., Chen, H., Ponge, D., & Raabe, D. (2021). Chemical heterogeneity enhances hydrogen resistance in high-strength steels. Nature Materials, 20, 1629
3. Zhao, H., Chakraborty, P., Ponge, D., Hickel, T., Sun, B., Wu, C.-H., Gault, B., & Raabe, D. (2022). Hydrogen trapping and embrittlement in high-strength Al-alloys. Nature, 602, 437
4. Han, L., Maccari, F., Filho, I. R. S., Peter, N. J., Wei, Y., Baptiste, G., Gutfleisch, O., Li, Z., & Raabe, D. (2022). A mechanically strong and ductile soft magnet with extremely low coercivity. Nature 608, 24
5. Raabe, D., C.C. Tasan, E.A. Olivetti, Strategies for improving the sustainability of structural metals, Nature 575 (2019) 64
6. Rao, Z.; Tung, P.; Xie, R.; Wei, Y.; Zhang, H.; Ferrari, A.; Klaver, T. P. C.; Körmann, F.; Sukumar, P. T.; da Silva, A. K.; et al. Machine Learning-Enabled High-Entropy Alloy Discovery. Science (80). (2022), 85, 78–85.
7. Kürsteiner, P.; Wilms, M. B.; Weisheit, A.; Gault, B.; Jäggle, E. A.; Raabe, D. High-Strength Damascus Steel by Additive Manufacturing. Nature 2020, 582 (7813), 515–519.

8. Jovičević-Klug, M., Souza Filho IR, Springer H, Adam C, Raabe D. 2024. Green steel from red mud through climate-neutral hydrogen plasma reduction. *Nature*. 625(7996):703–9
9. Raabe D, Rezaei Mianroodi J, Neugebauer J. 2023. Computational design of compositionally complex materials. *Nature Computational Science* 3:198–209
10. Raabe, D., Ponge, D., Uggowitzer, P., Roscher, M., Paolantonio, M., Liu, C., Antrekowitsch, H., Kozeschnik, E., Seidmann, D., Gault, B., De Geuser, F., Dechamps, A., Hutchinson, C., Liu, C., Li, Z., Prangnell, P., Robson, J., Shanthraj, P., Vakili, S., ..., Pogatscher, S. (2022). Making sustainable aluminum by recycling scrap: The science of “dirty” alloys. *Progress in Materials Science*, 100947.