Prof. Dr.-Ing. Horst Hahn

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Karlsruhe Institute of Technology
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University training and degree

1972-1978 Materials Science, University of Saarland, Saarbrücken; Dipl.-Ing. Materials Science

Advanced academic qualification

1978-1982 PhD program, Technical University Berlin; Degree: Dr.-Ing. Materials Physics
1982-1985 Post-doctoral fellow at University of Saarland, Saarbrücken, Germany

Postgraduate professional career

since 2025 Special Advisor to the Senior Vice President for Research & Partnerships and Professor, Department of Materials Science and Engineering, University of Arizona, USA
2022-2025 Distinguished Materials Visiting Professor, The University of Oklahoma, USA
since 2022 KIT Distinguished Senior Fellow, Karlsruhe Institute of Technology (KIT), Institute of Nanotechnology, Germany
2004-2022 Executive Director, Institute of Nanotechnology, Karlsruhe Institute of Technology (KIT), Germany
2004-2022 Head of KIT-TUD Joint Research Laboratory Nanomaterials, Institute of Materials Science, TU Darmstadt, Germany

2006-2019 Spokesperson of Helmholtz Programs in Nanotechnology at Karlsruhe Institute of Technology (KIT), Germany
2012-2022 Principal Investigator at Herbert Gleiter Institute of Nanoscience, Nanjing, China
2011-2015 Founding Director of Helmholtz Institute Ulm for Electrochemical Energy Storage, Germany
1992-2004 Full Professor, Institute of Materials Science, Technical University Darmstadt, Germany
1990-1992 Associate Professor (tenure) at Department of Materials Science and Engineering, Rutgers University, New Brunswick, USA
1987-1990 Research Assistant Professor, Department of Materials Science and Engineering, University of Illinois at Urbana-Champaign, USA
1985-1987 Research Associate, Materials Science Division, Argonne National Laboratory, USA

Calls

Calls for professorships: Rutgers University, New Jersey, USA (accepted, 1990); Technische Universität Darmstadt (accepted, 1992); University of Florida, Gainesville (denied, 1999); Research Center Karlsruhe (now KIT, accepted, 2004)

Honors and awards

- Honorary Fellowship of the Indian Academy of Sciences, Bengaluru, India (2025)
- Foreign Fellow of the Indian National Science Academy (2025)
- Foreign Fellow of the Indian National Academy of Engineering (2024)
- Fellow of the National Academy of Inventors, USA (2019)
- Foreign Member of the National Academy of Engineering, USA (2017)
- Member of Leopoldina – National Academy of Germany (2010)
- Member of The European Academy of Science (2010)
- Robert Franklin Mehl Award of The Minerals, Metals & Materials Society, USA (2013)
- Heyn Denkmünze of Deutsche Gesellschaft für Materialkunde (DGM), Germany (2012)
- Fellow of the Materials Research Society (MRS), Pittsburgh, USA (2010)
- Guest Professor at Lanzhou University, Lanzhou, China (2007)
- Distinguished Visiting Professor at University of California Irvine (2019 – 2023)
- Honorary Professor at Xi'an Jiaotong University, Xi'an, China (2018)
- Distinguished Professor at IIT Madras, India (lifetime position) (2005)
- Honorary Professor at University of Hyderabad, Physics Department, Hyderabad, India (2004)
- Nanotechnology Award of the Deutsche Bank, Berlin, Germany (jointly with Profs. Gleiter and Fecht) (2003)
- Visiting Professor at Nanyang Technological University, School of Materials Engineering, Singapore (2002)
- Fellowship of Fritz-Thyssen Foundation for highly-qualified young scientists (1982)

Selected positions and memberships in committees

- Chairman (Obmann) of Section Engineering Sciences of Deutsche Akademie der Naturforscher Leopoldina (German National Academy of Sciences), Halle, Germany (2016-2024)
- Member of University Council of University of Osnabrück, Germany (2020-2023)
- Member of Scientific Advisory Boards at IFW Dresden, IOM Leipzig and ZHM Hamburg
- Editor-in-Chief of Materials Science and Engineering A (2023-ongoing)
- Member of International Editorial Advisory Board of International Journal of Advances in Engineering Sciences and Applied Mathematics (2023-ongoing)
- Editor of Scripta Materialia (past)
- Editor of Materials Letters (past)
- Member and Chairman of International Committee on Nanostructured Materials (past)

Other professional activities

- Reviewer for Deutsche Forschungsgemeinschaft (DFG, National Science Foundation of Germany) for individual projects and for Consolidated Research Centers (CRC)
- Reviewer for projects for Federal Ministry of Education and Research (bmbf)
- Reviewer for European Research Council (ERC)
- Reviewer for US Department of Energy (DOE), individual applications and Energy Frontier Research Centers (EFRC)
- Reviewer for National Science Foundation (NSF)
- Reviewer for national funding agencies in Europe, for example, Switzerland, Poland, Austria, France, Italy, Spain, and others
- Reviewer for international peer-reviewed journals, such as Nature, Nature Materials, Nature Nanotechnology, Scientific Reports, Nature Reviews, Science, Progress in Materials Science, ACS Nano, Advanced Materials, Advanced Functional Materials, Advanced Electronic Materials, Journal of Applied Physics, Applied Physics Letters, Chemistry of Materials, IEEE Electron Device Letters, Journal of Magnetism and Magnetic Materials, Journal of Materials Chemistry, Journal of Materials Science, Acta Materialia, Scripta Materialia, Journal of Power Sources, Journal of the American Ceramic Society, Materials Letters, Materials Research Letters, Materials Today, Small, Solid State Ionics, Thin Solid Films, and more

Publications & patents

Publications: > 600 peer-reviewed publications; h-index = 81 (as of December 22, 2025)
Google Scholar: > 970 publications; h-index = 102; i10-index = 508

Patents:
> 70 patents and patent applications, incl. 14 US patents

Transfer activities

Several patents have resulted in technology transfer activities, including the creation of start-up companies.

- A patent based on research at Argonne National Laboratory led to the founding of Nanophase Technologies Inc. (formerly at www.nanophase.com), which is now Solésence, Inc. (https://solesence.com).
- Patents originating from research at Rutgers University resulted in the start-up NEI Corporation (www.neicorporation.com).
- At Technical University Darmstadt, the start-up Sustech GmbH was established as a public-private partnership between Henkel (https://www.henkel.de), the university, and five professors, all of whom held ownership stakes in the company. Sustech operated from 2002 until 2012.
- At KIT, the joint research laboratory Battery and Electrochemical Laboratory, BELLA (https://www.int.kit.edu/bella.php), was founded in 2011 through a collaboration between KIT and BASF SE.

Publications (important and highly cited in major research activities)

High entropy materials

1. S. Schweidler, M. Botros, F. Strauss, Q. Wang, Y. Ma, L. Velasco, G. Cadilha Marques, A. Sarkar, C. Kübel, H. Hahn, J. Aghassi-Hagmann, T. Brezesinski, B. Breitung, High-entropy materials for energy and electronic applications, **Nature Reviews Materials** (2024). https://doi.org/10.1038/s41578-024-00654-5.
2. L. Han, S. Zhu, Z. Rao, Ch. Scheu, D. Ponge, A. Ludwig, H. Zhang, O. Gutfleisch, H. Hahn, Z. Li, D. Raabe, Multifunctional High-Entropy Materials, **Nature Reviews Materials** (2024). https://doi.org/10.1038/s41578-024-00720-y

3. A. Sarkar, L. Velasco, D. Wang, Q. Wang, G. Talasila, L. de Biasi, C. Kübel, T. Brezesinski, S.S. Bhattacharya, H. Hahn, B. Breitung, High entropy oxides for reversible energy storage, **Nat. Commun.** 9 **(2018)** 3400. https://doi.org/10.1038/s41467-018-05774-5.
4. A. Sarkar, Q. Wang, A. Schiele, M.R. Chellali, S.S. Bhattacharya, D. Wang, T. Brezesinski, H. Hahn, L. Velasco, B. Breitung, High-Entropy Oxides: Fundamental Aspects and Electrochemical Properties, **Adv. Mater.** 31 **(2019)** 1806236. https://doi.org/10.1002/adma.201806236.
5. A. Sarkar, R. Djenadic, D. Wang, C. Hein, R. Kautenburger, O. Clemens, H. Hahn, Rare earth and transition metal based entropy stabilised perovskite type oxides, **J. Eur. Ceram. Soc.** 38 **(2018)** 2318–2327. https://doi.org/10.1016/j.jeurceramsoc.2017.12.058.
6. Y. Ma, Y. Ma, Q. Wang, S. Schweidler, M. Botros, T. Fu, H. Hahn, T. Brezesinski, B. Breitung, High-entropy energy materials: challenges and new opportunities, **Energy & Environ. Sci.** 14 **(2021)** 2883–2905. https://doi.org/10.1039/D1EE00505G.
7. R. Djenadic, A. Sarkar, O. Clemens, C. Loho, M. Botros, V.S.K. Chakravadhanula, C. Kübel, S.S. Bhattacharya, A.S. Gandhi, H. Hahn, Multicomponent equiatomic rare earth oxides, **Mater. Res. Lett.** 5 **(2017)** 102–109. https://doi.org/10.1080/21663831.2016.1220433.
8. Q. Wang, A. Sarkar, D. Wang, L. Velasco, R. Azmi, S.S. Bhattacharya, T. Bergfeldt, A. Düvel, P. Heitjans, T. Brezesinski, H. Hahn, B. Breitung, Multi-anionic and -cationic compounds: new high entropy materials for advanced Li-ion batteries, **Energy & Environ. Sci.** 12 **(2019)** 2433–2442. https://doi.org/10.1039/C9EE00368A.
9. A. Sarkar, R. Djenadic, N.J. Usharani, K.P. Sanghvi, V.S.K. Chakravadhanula, A.S. Gandhi, H. Hahn, S.S. Bhattacharya, Nanocrystalline multicomponent entropy stabilised transition metal oxides, **J. Eur. Ceram. Soc.** 37 **(2017)** 747–754. https://doi.org/10.1016/j.jeurceramsoc.2016.09.018.
10. A. Sarkar, C. Loho, L. Velasco, T. Thomas, S.S. Bhattacharya, H. Hahn, R. Djenadic, Multicomponent equiatomic rare earth oxides with a narrow band gap and associated praseodymium multivalency, **Dalt. Trans.** 46 **(2017)** 12167–12176. https://doi.org/10.1039/C7DT02077E.
11. R. Witte, A. Sarkar, R. Kruk, B. Eggert, R.A. Brand, H. Wende, H. Hahn, High-entropy oxides: An emerging prospect for magnetic rare-earth transition metal perovskites, **Phys. Rev. Mater.** 3 **(2019)** 034406. https://doi.org/10.1103/PhysRevMaterials.3.034406.

Simulation of materials processes

12. Z.-H. Jin, P. Gumbsch, K. Albe, E. Ma, K. Lu, H. Gleiter, H. Hahn, Interactions between non-screw lattice dislocations and coherent twin boundaries in face-centered cubic metals, **Acta Mater.** 56 **(2008)** 1126–1135. https://doi.org/10.1016/j.actamat.2007.11.020.
13. Z.-H. Jin, P. Gumbsch, E. Ma, K. Albe, K. Lu, H. Hahn, H. Gleiter, The interaction mechanism of screw dislocations with coherent twin boundaries in different face-centred cubic metals, **Scr. Mater.** 54 **(2006)** 1163–1168. https://doi.org/10.1016/j.scriptamat.2005.11.072.
14. S.-J. Zhao, K. Albe, H. Hahn, Grain size dependence of the bulk modulus of nanocrystalline nickel, **Scr. Mater**. 55 (2006) 473–476. https://doi.org/10.1016/j.scriptamat.2006.04.043

Nanocrystalline materials and nanoglasses: synthesis, characterization, properties

15. Yuan Tian, Xiaoguo Gong, Mingjie Xu, Caihao Qiu, Ying Han, Yutong Bi, Leonardo Velasco Estrada, Evgeniy Boltynjuk, Horst Hahn, Jian Han, David J. Srolovitz, Xiaoqing Pan, Grain rotation mechanisms in nanocrystalline materials: Multiscale observations in Pt thin films, **Science** 386 (2024) 49-54. https://doi.org/10.1126/science.adk6384.

16. R.W. Siegel, S. Ramasamy, H. Hahn, L. Zongquan, L. Ting, R. Gronsky, I. Introduction, Synthesis, characterization, and properties of nanophase TiO 2, **J. Mater. Res.** 3 **(1988)** 1367–1372. DOI: 10.1557/JMR.1988.1367.
17. H. Hahn, J. Logas, R.S. Averback, Sintering characteristics of nanocrystalline TiO_2, **J. Mater. Res.** 5 **(1990)** 609–614. https://doi.org/10.1557/JMR.1990.0609.
18. R. Schmechel, M. Kennedy, H. von Seggern, H. Winkler, M. Kolbe, R.A.A. Fischer, L. Xaomao, A. Benker, M. Winterer, H. Hahn, Luminescence properties of nanocrystalline Y2O3:Eu3+ in different host materials, **J. Appl. Phys.** 89 **(2001)** 1679. https://doi.org/10.1063/1.1333033.
19. H. Hahn, R.S. Averback, The production of nanocrystalline powders by magnetron sputtering, **J. Appl. Phys.** 67 **(1990)** 1113–1115. https://doi.org/10.1063/1.345798.
20. H. Hahn, K.A. Padmanabhan, A model for the deformation of nanocrystalline materials, **Philos. Mag. B.** 76 **(1997)** 559–571. https://doi.org/10.1080/01418639708241122.
21. H. Hahn, P. Mondal, K.A. Padmanabhan, Plastic deformation of nanocrystalline materials, **Nanostructured Mater.** 9 **(1997)** 603–606.
22. R.Z. Valiev, M.J. Zehetbauer, Y. Estrin, H.W. Höppel, Y. Ivanisenko, H. Hahn, G. Wilde, H.J. Roven, X. Sauvage, T.G. Langdon, The Innovation Potential of Bulk Nanostructured Materials, **Adv. Eng. Mater.** 9 **(2007)** 527–533. https://doi.org/10.1002/adem.200700078.
23. J.X. Fang, U. Vainio, W. Puff, R. Würschum, X.L. Wang, D. Wang, M. Ghafari, F. Jiang, J. Sun, H. Hahn, H. Gleiter, Atomic Structure and Structural Stability of $Sc_{75}Fe_{25}$ Nanoglasses, **Nano Lett.** 12 **(2012)** 458–463. https://doi.org/10.1021/nl2038216.

Irradiation effects

24. M. Rose, A.G. Balogh, H. Hahn, Instability of irradiation induced defects in nanostructured materials, **Nucl. Instruments Methods Phys. Res. Sect. B Beam Interact. with Mater. Atoms.** 127 **(1997)** 119–122. https://doi.org/10.1016/S0168-583X(96)00863-4.
25. S. Flege, H. Hahn, R.S. Averback, Thermal and radiation-enhanced diffusion in the bulk metallic glass $Ni_{23}Zr_{62}Al_{15}$, **Phys. Rev. B.** 69 (2004). https://doi.org/10.1103/PhysRevB.69.014303.
26. W. Voegeli, K. Albe, H. Hahn, Simulation of grain growth in nanocrystalline nickel induced by ion irradiation, **Nucl. Instruments Methods Phys. Res. Sect. B Beam Interact. with Mater. Atoms**. 202 (2003) 230–235. https://doi.org/10.1016/S0168-583X(02)01862-1.
27. F.R. Ding, R.S. Averback, H. Hahn, Radiation-enhanced diffusion in Ni/Zr diffusion couples, **J. Appl. Phys.** 64 (1988) 1785–1790. https://doi.org/10.1063/1.341776.
28. R.S. Averback, H. Hahn, Radiation-enhanced diffusion in amorphous Ni-Zr alloys, **Phys. Rev. B.** 37 (1988) 10383–10386. https://doi.org/10.1103/PhysRevB.37.10383.
29. R.S. Averback, H. Hahn, F.-R. Ding, Ion beam mixing and radiation-enhanced diffusion in metallic glasses, **J. Less Common Met.** 140 (1988) 267–275. https://doi.org/10.1016/0022-5088(88)90387-6.

Printed Electronics and Batteries

30. Y.Y. He, Y.Y. Ting, H.R. Hu, T. Diemant, Y.T. Dai, J. Lin, S. Schweidler, G.C. Marques, H. Hahn, Y.J. Ma, T. Brezesinski, P.M. Kowalski, B. Breitung, J. Aghassi-Hagmann, Printed high-entropy Prussian blue analogs for advanced non-volatile memristive devices, **Advanced Materials** (2024). https://doi.org/10.1002/adma.202410060.
31. A. Scholz, L. Zimmermann, U. Gengenbach, L. Koker, Z. Chen, H. Hahn, A. Sikora, M.B. Tahoori, J. Aghassi-Hagmann, Hybrid low-voltage physical unclonable function based on

inkjet-printed metal-oxide transistors, **Nat. Commun.** 11 (2020) 5543. https://doi.org/10.1038/s41467-020-19324-5.

32. T.T. Baby, M. Rommel, F. von Seggern, P. Friederich, C. Reitz, S. Dehm, C. Kübel, W. Wenzel, H. Hahn, S. Dasgupta, Sub-50 nm Channel Vertical Field-Effect Transistors using Conventional Ink-Jet Printing**, Adv. Mater.** 29 (2017) 1603858. https://doi.org/10.1002/adma.201603858.
33. T. Danner, M. Singh, S. Hein, J. Kaiser, H. Hahn, A. Latz, Thick electrodes for Li-ion batteries: A model based analysis, **J. Power Sources.** 334 **(2016)** 191–201. https://doi.org/10.1016/j.jpowsour.2016.09.143.
34. S.K. Garlapati, M. Divya, B. Breitung, R. Kruk, H. Hahn, S. Dasgupta, Printed Electronics Based on Inorganic Semiconductors: From Processes and Materials to Devices, **Adv. Mater.** 1707600 **(2018)** 1707600. https://doi.org/10.1002/adma.201707600.

Other topics

35. M. Pouryazdan, B.J.P. Kaus, A. Rack, A. Ershov, H. Hahn, Mixing instabilities during shearing of metals, **Nat. Commun**. 8 (2017) 1611. https://doi.org/10.1038/s41467-017-01879-5
36. J. Fang, S. Du, S. Lebedkin, Z. Li, R. Kruk, M. Kappes, H. Hahn, Gold Mesostructures with Tailored Surface Topography and Their Self-Assembly Arrays for Surface-Enhanced Raman Spectroscopy, **Nano Lett.** 10 **(2010)** 5006–5013. https://doi.org/10.1021/nl103161q.
37. A. Vijayaraghavan, S. Blatt, D. Weissenberger, M. Oron-Carl, F. Hennrich, D. Gerthsen, H. Hahn, R. Krupke, Ultra-Large-Scale Directed Assembly of Single-Walled Carbon Nanotube Devices, **Nano Lett.** 7 **(2007)** 1556–1560. https://doi.org/10.1021/nl0703727.
38. A. Melikyan, N. Lindenmann, S. Walheim, P.M.M. Leufke, S. Ulrich, J. Ye, P. Vincze, H. Hahn, T. Schimmel, C. Koos, W. Freude, J. Leuthold, Surface plasmon polariton absorption modulator, **Opt. Express.** 19 **(2011)** 8855. https://doi.org/10.1364/OE.19.008855.