

Prof. Dr. Patrik Schmuki

Swiss National Science Foundation PROFIL Fellowship

Fellow of the Electrochemical Society, USA

Fellow of the Royal Society of Chemistry

Honorary Professor for Physical Chemistry

at King Abdulaziz University

Fellow of the International Society of Electrochemistry

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>450 publications such as *Nature Materials*, *Nano Today*, *Angew. Chem. Int. Ed.*, *JACS*, *ACS Nano*, *Nano Lett.*, *Adv. Mater.*, an H-index of 69, and >18000 citations.

Professional Career

1988 Master of Science in Physical Chemistry – University of Basel (Switzerland)

1992 PhD – Swiss Federal Institute of Technology (ETH), Zürich (Switzerland)

1992 – 1992 Research Associate – ETH-Zürich (Switzerland)

1994 – 1995 Brookhaven National Laboratory, Materials Science Division & Brookhaven National Light Source, Upton, NY (USA)

1995 – 1997 National Research Council, Institute for Microstructural Sciences, Ottawa (Canada)

1997 – 2000 Associate Prof. for Microstructuring of Materials, Department of Materials Science, EPFL, Lausanne (Switzerland)

since 2000 Full professor and chair for Surface Science and Corrosion – University of Erlangen-Nürnberg (Germany)

since 2003 Several Research Stays – Guest professor, University of Burgundy, Dijon (France)

since 2007 PI Cluster of Excellence “Engineering of Advanced Materials” – University of Erlangen-Nürnberg (Germany)

Editorial Activity

Member of following Editorial Boards:

Chemistry Open

Electrochemistry Communications

ElectrochimicaActa

ActaBiomaterialia

ChemElectroChem

Corrosion Reviews

Awards and Honors

1992 ETH medal for the PhD Thesis

1995 Swiss National Science Foundation Fellowship for Advanced Researchers

1997 Swiss National Science Foundation PROFIL Fellowship

2005 H.H. Uhlig Award of the NACE-International, USA

2008 Fellow of the Electrochemical Society, USA

2008 Volta Award of the Electrochemical Society, USA

2010 Reinhart Koselleckgrant (German Research Foundation) – 1.5 Mio Euro

2011 H.H. Uhlig Award of the Electrochemical Society, USA

2012	Fellow of the Royal Society of Chemistry
2013	ERC-Grant for Advanced Researchers – 2.5 Mio Euro
2013	Honorary Professor for Physical Chemistry at King Abdulaziz University, Saudi Arabia
2013	Fellow of the International Society of Electrochemistry

Publications and Invitations to Meetings

Patrik Schmuki has a track record that includes >450 publications, an H-index of 69, and >18000 citations. On the list of publications are, for example, numerous *Angewandte Chemie Int. Ed.*, *JACS*, *Advanced Materials*, *Nano Letters*, and *Nature Materials*. His research has been outlined in journal covers and his publications include many most cited papers.

List of Selected Publications

1. K.R. Hebert, S.P. Albu, I. Paramasivam, P. Schmuki: "Morphological instability leading to formation of porous anodic oxide films", *Nature Materials*, 11 (2012) 162-167
2. Kowalski, Damian; Kim, Doohun; P. Schmuki: TiO₂ nanotubes, nanochannels and mesosponge: Self-organized formation and applications *NANO TODAY*, 2013, 8, 235-264.
3. Liu, Ning; Lee, Kiyong; P. Schmuki: Reliable Metal Deposition into TiO₂ Nanotubes for Leakage-Free Interdigitated Electrode Structures and Use as a Memristive Electrode *Angew. Chem. Int. Ed.*, 2013, 52, 12381-12384
4. So, Seulgi; P. Schmuki: Fast Electron Transport and High Surface Area: Potential Application of Porous Anatase Single Crystals in Solar Cells *Angew. Chem. Int. Ed.*, 2013, 52, 7933-7935.
5. Yoo, Jeong Eun; Lee, Kiyong; Altomare, Marco; et al. Self-Organized Arrays of Single-Metal Catalyst Particles in TiO₂ Cavities: A Highly Efficient Photocatalytic System *Angew. Chem. Int. Ed.*, 2013, 52, 7514-7517.
6. Lee, Chong-Yong; Lee, Kiyong; P. Schmuki: Anodic Formation of Self-Organized Cobalt Oxide Nanoporous Layers *Angew. Chem. Int. Ed.*, 2013, 52, 2077-2081.
7. Y. Yang, S.P. Albu, D. Kim, P. Schmuki: "Enabling the anodic growth of highly ordered V₂O₅ nanoporous/nanotubular structures", *Angewandte Chemie - International Edition*, 50 (2011) 9071-9075
8. P. Roy, S. Berger, P. Schmuki: "TiO₂ nanotubes: Synthesis and applications", *Angew. Chem. Int. Ed.*, 50 (2011) 2904-2939
9. Y.-Y. Song, P. Roy, I. Paramasivam, P. Schmuki " Voltage-induced payload release and wettability control on TiO₂ and TiO₂ nanotubes", *Angew. Chem. Int. Ed.*, 49 (2010) 351-354.
10. R. Hahn, F. Schmidt-Stein, J. Salonen, S. Thiemann, Y.-Y. Song, J. Kunze, V.-P. Lehto, P. Schmuki "Semimetallic TiO₂ Nanotubes", *Angew. Chem. Int. Ed.* 48 (2009) 7236 – 7239
11. D. Kim, K. Lee, P. Roy, B. I. Birajdar, E. Spiecker, P. Schmuki "Formation of a Non-Thickness-Limited Titanium Dioxide Mesosponge and its Use in Dye-Sensitized Solar Cells", *Angew. Chem. Int. Ed.* 48 (2009) 9326-9329.
12. A. Ghicov, M. Yamamoto, P. Schmuki "Lattice widening in Nb-doped TiO₂ nanotubes: Efficient ion intercalation and swift electrochromic contrast", *Angew. Chem. Int. Ed.* , 47 (2008) 7934-7937.
13. A. Ghicov, J.M. Macak, H. Tsuchiya, J. Kunze, V. Haeublein, L. Frey and P. Schmuki "Ion Implantation and Annealing for an Efficient N-Doping of TiO₂ Nanotubes", *Nano Letters*, 6 (2006) 1080.

14. A. Ghicov, S. Aldabergenova, H. Tsuchiya, and P. Schmuki "TiO₂-Nb₂O₅ Nanotubes with Electrochemically Tunable Morphologies", *Angew. Chem. Int. Ed.* 2006, 45, 6993–6996
15. J.M. Macak, H. Tsuchiya and P. Schmuki, "High-Aspect-Ratio TiO₂ Nanotubes by Anodization of Titanium", *Angew. Chemie* 117 (2005) 2136; and *Angew. Chem. Int. Ed.* 44 (2005) 2100.
16. W. Wei, H. Jha, G. Yang, R. Hahn, I. Paramasivam, S. Berger, E. Spiecker, P. Schmuki "Formation of self-organized superlattice nanotube arrays-embedding heterojunctions into nanotube walls", *Adv Mater.*, 22 (2010) 4770-4774.
17. P. Roy, C. Das, K. Lee, R. Hahn, T. Ruff, M. Moll, P. Schmuki: "Strongly enhanced and stable photoelectrochemical activity for water splitting", *J. Am. Chem. Soc.*, 133 (2011) 5629-5631
18. P. Roy, T. Dey, K. Lee, D. Kim, B. Fabry, P. Schmuki "Size-selective separation of macromolecules by nanochannel titania membrane with self-cleaning (Declogging) ability", *J. Am. Chem. Soc.*, 132 (2010) 7893-7895.
19. K. Lee, D. Kim, P. Roy, I. Paramasivam, B. I. Birajdar, E. Spiecker, P. Schmuki "Anodic formation of thick anatase TiO₂ mesosponge layers for high-efficiency photocatalysis", *J. Am. Chem. Soc.*, 132 (2010) 1478-1479.
20. Waldmann, Daniel; Butz, Benjamin; Bauer, Sebastian; et al. Robust Graphene Membranes in a Silicon Carbide Frame *ACS NANO*, 2013, 7, 4441-4448.
21. S. P. Albu, A. Ghicov, J. M. Macak, R. Hahn, P. Schmuki "Self-Organized, Free-Standing TiO₂ Nanotube Membrane for Flow-through Photocatalytic Applications", *Nano Lett.* 7 (2007) 1286
22. S. Funk, B. Hokkanen, U. Burghaus, A. Ghicov, and P. Schmuki "Unexpected adsorption of oxygen on TiO₂ nanotube arrays: Influence of crystal structure" *Nano Letters* 7 (2007) 1091
23. J. Park, S. Bauer, K. von der Mark, P. Schmuki "Nanosize and Vitality: TiO₂ Nanotube Diameter Directs Cell Fate", *Nano Lett.* 7 (2007) 1686
24. J. Park, S. Bauer, P. Schmuki, K. von der Mark "Narrow Window in Nanoscale Dependent Activation of Endothelial Cell Growth and Differentiation on TiO₂ Nanotube Surfaces", *Nano Lett.*, 9 (2009) 3157-3164.
25. K. von der Mark, S. Bauer, J. Park, P. Schmuki "Another look at "Stem cell fate dictated solely by altered nanotube dimension"", *PNAS Lett.*, 106 (2009) 1.
26. Y. Yang, K. Lee, M. Zobel, M. MacKovic, T. Unruh, E. Spiecker, P. Schmuki: "Formation of highly ordered VO₂ nanotubular/nanoporous layers and their supercooling effect in phase transitions", *Advanced Materials*, 24 (2012) 1571-1575
27. Lee, Kiyong; Hahn, Robert; Altomare, Marco; et al. Intrinsic Au Decoration of Growing TiO₂ Nanotubes and Formation of a High-Efficiency Photocatalyst for H₂ Production *Adv. Mater.*, 2013, 25, 6133-6137.
28. K. Yasuda and P. Schmuki "Formation of Self-Organized Zirconium Titanate Nanotube Layers by Alloy Anodization", *Adv. Mater.*, 19 (2007) 1757
29. J. M. Macak, B. G. Gong, M. Hueppe, and P. Schmuki "Filling of TiO₂ Nanotubes by Self-Doping and Electrodeposition", *Advanced Materials* 19 (2007) 3027
30. J. M. Macak, C. Zollfrank, B. J. Rodriguez, H. Tsuchiya, M. Alexe, P. Greil, P. Schmuki "Ordered Ferroelectric Lead Titanate Nanocellular Structure by Conversion of Anodic TiO₂ Nanotubes", *Adv. Mater.*, 21 (2009) 3121-3125.

31. S.P. Albu, A. Ghicov, S. Aldabergero, P. Drechsel, D. LeClere, G.E. Thompson, J.M. Macak, P. Schmuki "Formation of double walled TiO₂ nanotubes and robust anatase membranes", *Adv. Mater.*, 20 (2008) 4135-4139.
32. Y. Y. Song, F. Schmidt-Stein, S. Berger, P. Schmuki "TiO₂ nano test tubes as a self-cleaning platform for high-sensitivity immunoassays", *Small*, 6 (2010) 1180-1184.
33. J. Park, S. Bauer, A. Pittrof, M.S. Killian, P. Schmuki, K. Von Der Mark: "Synergistic control of mesenchymal stem cell differentiation by nanoscale surface geometry and immobilized growth factors on TiO₂ nanotubes", *Small*, 8 (2012) 98-107

International Conferences

Patrik Schmuki is a frequent *invited keynote speaker* at international conferences and has given numerous keynote and >100 invited talks, including 8 at the Gordon Research Conferences. He is a *conference and symposium organizer* at The Electrochemical Society (ECS), The International Society for Electrochemistry (ISE), Porous Semiconductor Science & Technology (PSST), etc.

Excellence in Research

Patrik Schmuki belongs to leading electrochemists in the world, especially in the field of electrochemical materials science. He has a very broad international experience and background [ETH-Zürich (Switzerland), Brookhaven Natl. Labs (USA), National Research Council (Canada), EPFL Lausanne (Switzerland), University of Erlangen-Nürnberg (Germany)]. He has made significant contributions in different disciplines of materials science: more than 300 research papers have been published in leading journals of their fields, for example in physics (Physical Review Letter), chemistry (Angewandte Chemie, JACS), materials science (Advanced Materials, Nature Materials), and nanotechnology (Nano Letters, Small). His key expertise is in the fields of micro-/nanostructures, surfaces/interfaces, thin film characterization, electrochemistry, photochemistry, and semiconductor chemistry. He has carried out pioneering work on the electrochemical growth of self-organized nanotubular transition metal oxide layers, their synthesis, properties, and applications. He demonstrated the first time controlled synthesis of high aspect ratio nanotubes (and now include oxide nanotube or nanopore formation on numerous metals such as Ta, Hf, W, Zr, Nb, V, as well as many alloys (for an overview, see Angewandte Chemie Int. Ed., 2011). Patrik Schmuki has developed the deep understanding of growth mechanisms (Nature Materials, 2012) necessary to create self-organized oxide systems. Furthermore, by tailoring the optical, electronic and chemical properties of the nanotube arrays, Patrik Schmuki has enabled innumerable important technological applications of these amazing structures, including templates for catalysts, solar cells, with increase electron mobilities.

Patrik Schmuki's mentoring of a very high number of international PhD students and post-docs throughout his research has greatly enriched the community. He has hosted many self-funded research fellows, with prestigious grants (Alexander von Humboldt, Marie-Curie, Japan Society for Promoting Science, Korean Science Foundation). 8 of the students and PostDocs, who carried out research under his supervision, now hold faculty positions.

Activities in International Societies

Patrik Schmuki is an active member of the Electrochemical Society (ECS) and of the International Society of Electrochemistry (ISE), holding many committee positions in these societies. From 2007-2008, he was member of the Board of Directors of the Electrochemical Society. From 2010-2011, he was Chair of the New Technology Committee of the Electrochemical Society. Moreover, he started as a member (2000-2005) of Corrosion Division of the Electrochemical Society, and then became Vice-Chair (2005-2006) and Chair (2007-2008) of the Division. He also served as a Chairman of the European Section of the Electrochemical Society from 2002-2004. Since 2010, he is Chair of Division 4 (Electrochemical Materials Science) of the International Society of Electrochemistry. From 1999-2009, he was a member of the Executive Committee of the International Corrosion Council.

Organization of International Conferences

Fall and Spring Meetings of the Electrochemical Society, since 1997
(various locations in Europe, the USA, and Canada), typically organizing one symposium in a year

Role in conference: Chairman and Symposium Organizer

Annual Meetings of the International Society of Electrochemistry

Role in conference: Symposium Organizer

Porous Semiconductor Science and Technology (PSST), 2008, 2010

Role in conference: Chair and Conference Organizer

5th Kurt-Schwabe Symposium (From Corrosion to Semiconductors), 2009, Erlangen

Role in conference: Chairman

Kyoto-Erlangen Symposium on Advanced Energy and Materials

2003, Erlangen, Chair: Patrik Schmuki

2006, Kyoto, Co-Chair: Patrik Schmuki

2009, Erlangen, Chair: Patrik Schmuki