**Tim Seibert (Graening), PhD**

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# Research Specialization

Materials science   
Nanostructured materials   
Fusion and fission materials  
Powder metallurgy  
Coatings  
Biomaterials

# Education

02/2013 – 09/2017 *Doctoral degree in engineering* (Dr.-Ing.) with a focus on Materials Science  
**Karlsruhe Institute of Technology, Germany, Advisor: Prof. Dr. Anton Moeslang** Production, characterization and optimization of austenitic oxide dispersion strengthened steels, Honors: magna cum laude

07/2012 – 12/2012 *Master‘s thesis* (M.Sc.)  
**Technical University of Berlin & Biotronik, Germany**  
Comparison of the properties and processability of standard 35N LT and 35N LT NDR (Nanograin Damage Resistance) for the application as an electrode in a pacemaker  
grade: 1.3 (range: 1.0 – 5.0; best:1.0)

08/2010 – 12/2012 *Study of Materials Science*  
**Technical University of Berlin, Germany**  
Focus: Materials selection, biomaterials, metals  
grade: 1.3 (range: 1.0 – 5.0; best:1.0)

04/2010 – 09/2010 *Bachelor’s thesis* (B.Sc.)  
**Technical University of Berlin, Germany**  
Materials selection for a concrete pump system   
grade: 1.3 (range: 1.0 – 5.0; best:1.0)

10/2007 – 09/2010 *Study of Materials Science*  
**Technical University of Berlin, Germany**  
Focus: Polymere, ceramics, metals, glass  
grade: 2.1 (range: 1.0 – 5.0; best:1.0)

# Work Experience

Since 09/2020 *Research Staff Associate*  
 **Oak Ridge National Laboratory,** Materials Science and Technology Division   
 - Development of Cr-coatings on Zr-based cladding for nuclear power plants

- Technical lead on additive manufacturing of tungsten and AFA ODS steels

- Development of CNA steels for fusion power plants

- Research on EUROFER97 irradiation behavior  
 - T2M Lead for ARPA-E projects  
 - Deputy PI for ARPA-E projects

10/2017 – 02/2020 *Postdoctoral* *Research Associate*  
 **Karlsruhe Institute of Technology,** Applied Materials Physics Group   
 **Advisor: Dr. Michael Rieth, Prof. Dr. Anton Moeslang**  
 Delegation to the Oak Ridge National Laboratory to collaborate on irradiated  
 Eurofer97 material

07/2015 – 10/2015 *Visiting Researcher*   
 **Oak Ridge National Laboratory (ORNL)**

Atom probe tomography and transmission electron microscopy of  
 novel austenitic oxide dispersion strengthened steels

02/2013 – 09/2017 *Research Associate*   
**Karlsruhe Institute of Technology, IAM-AWP**  
- Development of a production process for oxide dispersion strengthened  
 austenitic steels via mechanical alloying from powder to a tube  
- Implementation of a double milling process   
- Microstructural investigation using SEM, TEM, XAFS and XRD methods  
- Mechanical testing of extruded and hot-rolled samples

11/2010 – 11/2012 *Student Assistant & Tutor*  
**Institute of Materials Engineering, TU Berlin**

Lecturing student groups of around 30 people and conducting and analyzing experiments

08/2011 – 10/2012 *Research internship*  
**R&D Electrodes for pacemakers, Biotronik**

Mechanical testing of electrodes and planning of new fatigue experiments

# Awards

2014 **Best Poster Award**, 3rd place Junior EUROMAT, Lausanne, Switzerland.

# Patent

2022 **A design of transition layer structure between RAFM steels and W** **Invention ID: 81936710**

# Publications (h-index 9, Google Scholar)

**Published**

2023 Robin, I., Graening, T., Yang, Y., Haider, S.B., Lass, E., Katoh, Y.; Zinkle, S.  
 “Evaluation of Tungsten—Steel Solid-State Bonding: Options and the Role of CALPHAD to Screen Diffusion Bonding Interlayers”   
 *Metals 13, 1438* (2023)

2023 Tim Graening, Lizhen Tan, Ishtiaque Robin, Yutai Katoh, Ying Yang,  
 “A novel design of transitional layer structure between reduced activation ferritic martensitic steels and tungsten for plasma facing materials,”   
 *Journal of Materials Research and Technology, Volume 24,* (2023)

2023 C. Ledford, P. Fernandez-Zelaia, T. Graening, Q. Campbell, J.O. Rojas, A.M. Rossy, Y. Kato, M.M. Kirka,  
 “Microstructure and high temperature properties of tungsten processed via electron beam melting additive manufacturing”   
 *International Journal of Refractory Metals and Hard Materials* (2023)

2023 W. Zhong, H. Wang, R.D. McAuliffe, Y. Yan, S. Curlin, T. Graening, A. Nelson   
 “Hydrogen effects on thermal diffusivity and electrical resistivity of zircaloy cladding”   
 *Journal of Nuclear Materials* 574 (2023): 154213

2023 Mackenzie Ridley, Samuel Bell, Ben Garrison, Tim Graening, Nathan Capps, Yi- Feng Su, Peter Mouche, Brandon Johnston, Kenneth Kane  
 “Effects of Cr/Zircaloy-4 coating qualities for enhanced accident tolerant fuel cladding”   
 *Annals of Nuclear Energy, 188,* (2023)

2023 K.A. Kane, S.B. Bell, N. Capps, B. Garrison, K. Shapovalov, G. Jacobsen,   
 C. Deck, T. Graening, T. Koyanagi, C. Massey   
 “The response of accident tolerant fuel cladding to LOCA burst testing: A comparative study of leading concepts”   
 *Journal of Nuclear Materials* 574 (2023): 154152

2022 Y. Yan, T. Graening, A. T. Nelson  
 “Hydriding, Oxidation, and Ductility Evaluation of Cr-Coated Zircaloy-4 Tubing”   
 *Metals 2022*, 12 (12)

2022 S.B. Bell, T. Graening, A. Evans, P. Kelly, B.A. Pint, K.A. Kane   
 “Burst and oxidation behavior of Cr-coated Zirlo during simulated LOCA testing”   
 *Journal of Nuclear Materials* 564 (2022): 153679

2022 T. Graening, N. Sridharan   
 “Benchmarking a 9Cr-2WVTa Reduced Activation Ferritic Martensitic Steel   
 Fabricated via Additive Manufacturing”   
 *Metals 2022, 12, 342*

2022 C.P. Massey, P.D. Edmondson, M.N. Gussev, K. Mao, T. Graening, T. J.Nizolek, S.A. Maloy, D. Sornin, Y. de Carlan, S.N. Dryepondt, D.T. Hoelzer  
 “Insights from microstructure and mechanical property comparisons of three  
 pilgered ferritic ODS tubes"  
 *Materials & Design 213* (2022):110333

2022 T. Graening, M. Rieth, H. Leiste, S. Mumbauer, M. Duerrschnabel, A. Moeslang  
 "On the mechanical alloying of novel austenitic dual precipitation strengthening   
 steel"  
 *Materials & Design 213* (2022):110316

2021 A. Bhattacharya, X. Chen, T. Gräning, J.W. Geringer, J. Henry, L. Pilloni,   
 D. Terentyev, A. Puype, J. Reed, S. Byun, M. Rieth, S.J. Zinkle,   
 Y. Katoh, L. Snead  
 "Irradiation hardening and ductility loss of Eurofer97 steel variants after neutron  
 irradiation to ITER-TBM relevant conditions"  
 *Fusion Engineering and Design* (2021) 173:112935

2021 M. Rieth, E. Simondon, G. Pintsuk, G. Aiello, J. Henry, D. Terentyev, A. Puype,   
 C. Cristalli, L. Pilloni, O. Tassa, M. Klimenkov, H.C. Schneider, P. Fernandez,   
 T. Gräning, X. Chen, A. Bhattacharya, J. Reed, J.W. Geringer, M. Sokolovk,   
 Y. Katoh, L. Snead  
 "Technological aspects in blanket design: Effects of micro-alloying and thermo-  
 mechanical treatments of EUROFER97 type steels after neutron irradiation"  
 *Fusion Engineering and Design* (2021): 112645

2020 X. Chen, L. Clowers, T. Graening, A. Bhattacharaya, A. Campbell, J. Robertson,   
 J. Geringer, M. Sokolov, Y. Katoh, M. Rieth  
 "Post-Irradiation Evaluation of Eurofer97 Fracture Toughness Using Miniature  
 Multinotch Bend Bar Specimens"  
 *ASME 2020 Pressure Vessels & Piping Conference* (2020): PVP2020-21312

2020 L. Tan, T. Graening, X. Hu, W. Zhong, Y. Yang, S.J. Zinkle, Y. Katoh,  
 "Effects of carbonitrides and carbides on microstructure and properties of castable   
 nanostructured alloys"  
 *Journal of Nuclear Materials* 540 (2020): 152376

2019 T. Graening, M. Klimenkov, M. Rieth, C. Heintze, A. Moeslang  
 "Long-term stability of the microstructure of austenitic ODS steel rods produced with a carbon-containing process control agent"  
 *Journal of Nuclear Materials* 523 (2019): 111-120

2019 T. Graening, M. Rieth, J. Hoffmann, S. Seils, P.D. Edmondson, A. Moeslang "Microstructural investigation of an extruded austenitic oxide dispersion strengthened steel containing a carbon-containing process control agent" *Journal of Nuclear Materials* 516 (2019): 335-346.

2019 D. Litvinov, A. Chauhan, T. Graening, J. Aktaa  
 "Microstructure characterization of a novel austenitic ODS steel by transmission  
 electron microscopy”  
 *Materialia* Volume 5, (2019), 100176

2019 X. Chen, A. Bhattacharya, M. Sokolov, L.N. Clowers, Y. Yamamoto,   
 T. Graening, K.D. Linton, Y. Katoh, M. Rieth  
 "Mechanical property and microstructure characterization of Eurofer97 steel   
 variants in EUROfusion"  
 *Fusion Engineering and Design 146,* (2019): 2227-2232

2018 A. Chauhan, D. Litvinov, T. Graening, J. Aktaa  
 "High-temperature low-cycle fatigue behavior and microstructural evolution of an  
 improved austenitic ODS steel”  
 *Journal of Materials Research* 33, (2018): 1814-1821.

2018 T. Graening, M. Rieth, A. Moeslang, A. Kuzmin, A. Andris, J. Timoshenko,   
 A. Cintins, J. Purans  
 "Investigation of precipitate in an austenitic ODS steel containing a carbon-rich process control agent”  
 *Nuclear Materials and Energy* 15, (2018): 237-243.

2017 T. Graening  
 "Herstellung, Charakterisierung und Optimisierung von austenitischen ODS  
 Staehlen"  
 *Karlsruher Schriftenreihe (2017)*.

2017 T. Graening, J. Hoffmann, M. Rieth, A. Moeslang  
 "Production, microstructure and mechanical properties of two different   
 austenitic ODS steels"   
 *Journal of Nuclear Materials* 487 (2017): 348-361.

2016 I. Jonane, K. Lazdins, J. Timoshenko, A. Kuzmin, J. Purans, P. Vladimirov,  
 T. Graening, J. Hoffmann  
 "Temperature-dependent EXAFS study of the local structure and lattice dynamics in cubic Y2O3"  
 *Journal of synchrotron radiation* 23, (2016): 510-518.

2016 L. Strassberger, A. Chauhan, T. Graening, S. Czink, J. Aktaa  
 "High-temperature low-cycle fatigue behavior of novel austenitic ODS steels"  
 *International Journal of Fatigue* 93, (2016): 194-200.

2015 A. Cintins, A. Anspoks, J. Purans. A. Kuzmin, J. Timoshenko, P. Vladimirov, T. Graening, J. Hoffmann  
 "ODS steel raw material local structure analysis using X-ray absorption   
 spectroscopy"  
 *IOP Conference Series: Materials Science and Engineering* 77, (2015).

2015 J. Reiser, M. Rieth; A. Möslang, H. Greuner, D. Armstrong, T. Denk, T. Graening, W. Hering, A. Hoffmann, J. Hoffmann  
 "Tungsten (W) laminate pipes for innovative high temperature energy conversion  
 systems"  
 *Advanced Engineering Materials* 17, (2015): 491-501.

# Conference Contributions

**Oral Presentations**

05/2023 T. Graening, Y. Yang, I. Robin, D. Ebeperi, I. Karaman, Y. Katoh  
 " *Transition Layer Design for Divertor and First Wall Components: From*  *Tungsten to Steel*"  
 *PFMC 2023*, Bonn, Germany.

03/2023 T. Graening, Y. Katoh, M. Kirka, Y. Yang, M. Wang, J. Ye, I. Karaman  
 "*Novel Transitional Layer Structure Between Reduced Activation Ferritic*  
 *Martensitic Steels and Tungsten for Fusion Reactors*"  
 *TMS 2023*, San Diego, CA, USA.

09/2022 T. Graening, L. Tan, W. Zhong, P. Patki, K. Field, Y. Yang, Y. Katoh " *Castable nanostructured alloy steels as enhanced reduced activation ferritic*  *martensitic steels*"  
 *SOFT 2022*, Dubrovnik, Croatia.

10/2021 T. Graening, W. Zhong, L. Tan, P. Patki, K. Field   
 "*Role of MC and M23C6 Precipitates in Radiation Resistance and Helium*  *Distribution*"  
 *ICFRM20, 2021*, Granada, Spain.

11/2017 T. Graening, M. Rieth, M. Klimenkov, S. Seils, P. Edmondson, C. Heintze, A. Kuzmin, A. Anspoks, J. Timoshenko, A. Cintins, A. Moeslang   
 "*Long-term stability of austenitic ODS steels*"  
 *ICFRM-18*, Aomori, Japan.

05/2017 T. Graening, M. Rieth, A. Moeslang   
 "*Relationship of microstructure and mechanical properties of austenitic ODS*  *steels*"  
 7th *FUSION Seminar*, St. Martin, Germany.

04/2016 T. Graening, M. Rieth, A. Moeslang   
 "*Influence of annealing and the production route on austenitic ODS steels*"  
 *3nd ODISSEUS Workshop*, Dresden, Germany.

02/2016 T. Graening, M. Rieth, A. Moeslang   
 "*Advanced* *development of austenitic ODS steels*"  
 *JAGER*, Karlsruhe, Germany.

05/2015 T. Graening, M. Rieth, A. Moeslang   
 "*Insights into the microstructure of austenitic ODS steels*"  
 *ICM 12*, Karlsruhe, Germany.

03/2015 T. Graening, M. Rieth, A. Moeslang   
 "*Austenitic ODS steels*"  
  *2nd ODISSEUS Workshop*, Dresden, Germany.

09/2014 T. Graening, M. Rieth, A. Moeslang   
 "*Comparison between hot isostatic pressed and extruded austenitic ODS steels*"  
 *MSE*, Darmstadt, Germany.

05/2014 T. Graening, J. Hoffmann, M. Rieth, A. Moeslang   
 "*Mechanical alloying of austenitic ODS steels for high temperature applications*"  
 *4th FUSION Seminar*, St. Martin, Germany.

03/2014 T. Graening, J. Hoffmann, M. Rieth, A. Moeslang   
 "*Nano-scaled austenitic ODS steels for high temperature applications*"  
 *JAGER,* Kyoto, Japan.

12/2013 T. Graening, M. Rieth, A. Moeslang   
 "*Development of nano-scaled austenitic ODS steels for Fusion applications* "  
  *ODISSEUS Workshop*, Dresden, Germany

05/2013 T. Graening, J. Hoffmann, M. Rieth, A. Moeslang   
 "*Development and evaluation of nano-scaled austenitic ODS steels for high*  *temperature applications*"  
 *3th* *FUSION Seminar*, St. Martin, Germany.

# Poster Presentations

03/2019 T. Graening, L. Tan, Y. Yang, A. Bhattacharya, Y. Katoh  
 "*Optimization of nitrogen-containing castable nanostructured alloys*"  
 *TMS 2019,* San Antonio, USA.

10/2018 T. Graening, M. Klimenkov, M. Rieth, C. Heintze, A. Moeslang  
 "*Long-term stability of the microstructure of austenitic ODS steel rods produced with a carbon-containing process control agent*"  
 *NUMAT,* Seattle, USA.

03/2018 T. Graening, J. Hoffmann, S. Seils, M. Rieth, A. Moeslang  
 *"Development of austenitic ODS Steel for future fusion power plants"*   
 *KIT International Evaluation 2018,* Karlsruhe, Germany.

09/2015 T. Graening, J. Hoffmann, M. Rieth, A. Moeslang  
 *"A fabrication study on austenitic ODS steel"*   
 *ICFRM-17,* Aachen, Germany.

07/2014 T. Graening, J. Hoffmann, M. Rieth, A. Moeslang  
 *"Mechanical alloying of austenitic ODS steels for high temperature applications"*   
 *Junior EUROMAT,* Lausanne, Switzerland.  
**Best Poster Award**, 3rd place

**Research Visits**

**Oak Ridge National Laboratory, USA**  
 Collaboration of the EUROfusion irradiation campaign of the KIT and ORNL

Dr.Yutai Katoh (2 years 3 months, 09/2017 – 12/2019)

**Helmholtz Zentrum Dresden-Rossendorf, Germany** *TEM investigation of annealed austenitic ODS steel*

Dr. Cornelia Heintze (1 week, 2016)

**ELETTRA Synchrotron Trieste, Italy** *XAFS investigation of novel PCA-containing austenitic ODS steel during annealing*

*up to 1000 ℃* (1 week, 2016)

**Oak Ridge National Laboratory, USA**  
 Atom probe tomography and transmission electron microscopy of novel austenitic oxide dispersion strengthened steels

Dr.Yutai Katoh (12 weeks, 2015)

**Strangpresszentrum Berlin, Germany**  
 Investigation of the extrusion process of austenitic ODS steels

Dr. Soeren Mueller (1 week, 2015)

**ELETTRA Synchrotron Trieste, Italy** In-situ *XAFS investigation of austenitic and ferritic ODS steels during annealing up to 1000 ℃* (1 week, 2014)

**Plataforma Solar de Almeria, Spain** *HFF test of tungsten foil laminate pipes* (1 week, 2013)

# Continuing Education

* Impactful presentations in science, KIT, 2016
* Leadership skills for Ph.D. students, KIT, 2015
* Carrier and leadership. Helmholtz Association and Research Schools, 2015
* TEM course, KIT, 2014
* Communication and presentation skills, Helmholtz Association and Research Schools, 2014
* Nano-scale materials and advanced characterization techniques, DGM, 2013
* Research skills development. Helmholtz Association and Research Schools, 2013

# Hardware & Software Skills

**Analytical Microscopy:**

* TEM, STEM, HREM, EDS, on FEI suite of transmission electron microscopes
* SEM, EDS, WDS, EBSD on FEI and Zeiss suite of scanning electron microscopes
* Optical light microscopy, confocal laser scanning microscopy
* FIB and electro polished TEM sample preparation
* OIM and TEAM
* Digital Micrograph
* TEM Imaging & Analysis
* Gatan Microscopy Suite
* ImageJ

**X-ray Diffraction:**

* Powder and bulk diffraction
* Williamson-Hall and Rietveld analysis
* MAUD
* TOPAS
* DIFFRAC.EVA

**Material Processing:**

* High energy ball milling
* Extrusion and hot rolling
* Annealing
* Additive Manufacturing (DED, LPBF, EBM)

**Mechanical Testing:**

* Tensile, Charpy and hardness testing

**Desktop Editing and Productivity Software:**

* Microsoft Office, OpenOffice.org, Google Docs
* CorelDraw, Corel Photo-Paint
* Python scripting – beginner level

# Professional Activities and Service

Since 09/2018 Reviewer for Metals, MDPI

Since 09/2018 Reviewer for Materials, MDPI

Since 06/2017 Reviewer for Journal of Nuclear Materials, Elsevier

05/2006 – 12/2012 Table tennis coach for kids between 8 and 18 years old

06/2004 – 07/2007 Lifeguard at the Baltic Sea