

# Prof. Dr.-Ing. IYAS KHADER

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## RESEARCH FOCUS

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- Finite element modeling of tribological systems
- Application of engineering ceramics in tribological systems
- Modeling hydrogen diffusion in tribological contact

## PROFESSIONAL EXPERIENCE

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Sept. 2021 – present

**Dean**

School of Applied Technical Sciences (SATS)  
**German-Jordanian University, Amman, Jordan**

July 2021 – present

**Professor**

Department of Industrial Engineering  
**German-Jordanian University, Amman, Jordan**

**Editorial Board Member** for the *Journal of Mechanical Engineering*

**Regular Reviewer** for the Journals: *Wear, Journal of the European Ceramic Society, Ceramics International, International Journal of Fatigue, Engineering Failure Analysis* and others

**Advisor, co-advisor and mentor** for bachelor, master, and doctoral students at the German Jordanian University and the Fraunhofer Institute for Mechanics of Materials IWM

Sept. 2020 – Sept. 2021

**Assistant Dean for Accreditation and Quality Assurance**

School of Applied Technical Sciences (SATS)  
**German-Jordanian University, Amman, Jordan**

Heading the committee responsible for the German accreditation of all study programs offered by SATS in collaboration with the accreditation agency ASIIN

June 2016 – July 2021

**Associate Professor**

Department of Industrial Engineering  
**German-Jordanian University, Amman, Jordan**

August 2018 – Sept. 2020

**Visiting Researcher**

Tribology Unit  
**Fraunhofer Institute for Mechanics of Materials IWM, Freiburg, Germany**

Feb. 2012 – June 2016

**Assistant Professor**

Department of Industrial Engineering  
**German-Jordanian University, Amman, Jordan**

Feb. 2013 – Oct. 2015

**Head of Industrial Engineering Department**

Department of Industrial Engineering  
**German-Jordanian University, Amman, Jordan**

Dec. 2011 – Dec. 2014

Assistant Coordinator for Research and Technical Development (RTD) of the FP-7 EU project **RoLiCer** ([www.rolicer.eu](http://www.rolicer.eu)). RoLiCer (Enhanced reliability and lifetime of ceramic components through multiscale modelling of degradation and damage) is a collaborative research project that focuses on multi-scale modeling of degradation mechanisms in engineering ceramics (Coordinator: Dr. Andreas Kailer, Fraunhofer IWM)

June 2010 – Dec. 2011

**Postdoctoral Researcher**

Institute for Applied Materials IAM-ZBS

**Karlsruhe Institute of Technology KIT, Karlsruhe, Germany, and**

Department of Wear Protection and Advanced Ceramics

**Fraunhofer Institute for Mechanics of Materials IWM, Freiburg, Germany**

- Directly responsible for the proposal preparation and acquisition of a multinational project, involving five European countries and seven worldwide renowned research institutions, higher education establishments and industrial partners with a total budget of 3.2 million € RoLiCer ([www.rolicer.eu](http://www.rolicer.eu))
- Acquisition of several collaborative research projects
- Engagement in several collaborative research projects between Fraunhofer IWM and various research institutions and industrial companies throughout Germany

August 2006 – June 2010

**Research Assistant**

Institute for Reliability of Components and Systems IZBS

**Karlsruhe Institute of Technology KIT, Karlsruhe, Germany, and**

Department of Wear Protection and Advanced Ceramics

**Fraunhofer Institute for Mechanics of Materials IWM, Freiburg, Germany**

Research work focused on experimental and numerical damage analysis of engineering ceramics in bulk metal-forming processes

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## EDUCATION

August 2006 – June 2010

**Ph.D. in Material Science and Engineering, Dr.-Ing. (magna cum laude)**

Institute for Applied Materials (IAM-ZBS)

**Karlsruhe Institute of Technology KIT, Karlsruhe, Germany**

Dissertation: Damage mechanisms in silicon nitride rolling tools applied in caliber rolling copper and steel wires (Advisor: Prof. Dr. Peter Gumbsch)

October 2003 – August 2006

**M.Sc. in Mechatronics**

**Hamburg University of Technology, Hamburg, Germany**

Thesis: Comparison of flutter results obtained from various analyses for a sample wing,  
Department of Reliability Engineering

October 1998 – July 2003

**B.Sc. in Mechanical Engineering**

**University of Jordan, Amman, Jordan**

Thesis: Response of non-linear systems to non-stationary excitations, Department of  
Mechanical Engineering

## SCIENTIFIC PUBLICATIONS

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**I. Khader**, Modeling Wear using the Finite Element Method in Abaqus® in L. R. De Tembleque Solano, J. Vazquez Valeo and M.H. Aliabadi (Eds.) Computational and Experimental Methods in Structures, Volume 12: Wear in Advanced Engineering Applications and Materials, World Scientific Publishing Co Pte Ltd, accepted for publication.

P. Berlet, D. Hoffmann, K. Pöhlmann, A. Kailer, **I. Khader**, D. Kürten, R. Luther, J. Rausch, C. Rynio, J. Neuhaus, Tribologische Aspekte zukünftiger Verbrennungsmotoren für Power-to-X, submitted to the 62<sup>nd</sup> German Tribology Conference 2021, Sept. 27<sup>th</sup> – Sept. 29<sup>th</sup>, **2021**, Online.

B. Zhao, **I. Khader**, H. Liu, T. Zhou, G. Konrath, A. Kailer, Tribological characterization of an alumina-based composite in dry sliding contact against laser-heated and unheated Inconel 718, *Tribology International* (2021) 155–106773. DOI: [10.1016/j.triboint.2020.106773](https://doi.org/10.1016/j.triboint.2020.106773).

**I. Khader**, D. Kürten, A. Kailer, The influence of mechanical stresses on the diffusion and accumulation of hydrogen in a cylindrical roller thrust bearing, *Bearing World Journal*, 5 (2020), 81–91. [https://www.vdma-verlag.com/home/download\\_1070A.html](https://www.vdma-verlag.com/home/download_1070A.html)

**I. Khader**, D. Kürten and A. Kailer, The influence of mechanical stresses on the diffusion and accumulation of hydrogen in a CRTB, in Bearing World 2020, 19-23 Oct., **2020**.

**I. Khader**, C. Koplín, C. Schröder, J. Stockmann, W. Beckert, W. Kunz, A. Kailer, Characterization of a silicon nitride ceramic material for ceramic springs, *Journal of the European Ceramic Society* (2020) 40(10) 3541-3554. DOI: [10.1016/j.jeurceramsoc.2020.03.046](https://doi.org/10.1016/j.jeurceramsoc.2020.03.046).

D. Kürten, **I. Khader**, A. Kailer, Determining the effective hydrogen diffusion coefficient in 100Cr6, *Materials and Corrosion* (2020) 71(6) 918-923. DOI: [10.1002/maco.201911322](https://doi.org/10.1002/maco.201911322).

D. Kürten, **I. Khader**, A. Kailer, Tribochemical degradation of vacuum-stable lubricants: A comparative study between multialkylated cyclopentane and perfluoropolyether in a vacuum ball-on-disc and full-bearing tests, *Lubrication Science* (2020) 32(4) 183-191. DOI: [10.1002/ls.1494](https://doi.org/10.1002/ls.1494).

B. Zhao, **I. Khader**, R. Raga, U. Degenhardt, A. Kailer, Tribological behavior of three silicon nitride ceramics in dry sliding contact against Inconel 718 over a wide range of velocities, *Wear* (2020) 448-449 203206. DOI: [10.1016/j.wear.2020.203206](https://doi.org/10.1016/j.wear.2020.203206).

- D. Kürten, **I. Khader**, A. Kailer, Wasserstofffreisetzung im Wälzkontakt, *Tribologie und Schmierungstechnik* (2019) 66(4-5) 44-50. DOI: [10.30419/TuS-2019-0023](https://doi.org/10.30419/TuS-2019-0023).
- B. Zhao, **I. Khader**, R. Raga, G. Konrath, U. Degenhardt, A. Kailer, High temperature tribological properties of silicon nitride in dry sliding contact against Inconel 718 heated by laser, *Wear* (2019) 434-435 203000. DOI: [10.1016/j.wear.2019.203000](https://doi.org/10.1016/j.wear.2019.203000).
- D. Kürten, **I. Khader**, A. Kailer, Hydrogen assisted rolling contact fatigue, 13<sup>th</sup> VDI-Fachtagung „Gleit- und Wälzlagerungen, 5-6 June 2019, Schweinfurt, Germany, VDI-Berichte 2348, VDI Wissensforum GmbH, Düsseldorf, 2019, ISBN 978-3-18-092348-2, 273-286.
- D. Kürten, **I. Khader**, R. Raga, P. Casajús, N. Winzer, R. Spallek, M. Scherge, A. Kailer, Hydrogen assisted rolling contact fatigue due to lubricant degradation and formation of white etching areas, *Engineering Failure Analysis* (2019) 99 330-342. DOI: [10.1016/j.engfailanal.2019.02.030](https://doi.org/10.1016/j.engfailanal.2019.02.030).
- R. Raga, **I. Khader**, Z. Chlup, A. Kailer, Damage progression in silicon nitride undergoing non-conforming hybrid cyclic contact, *International Journal of Fatigue* (2017) 105 97-110. DOI: [10.1016/j.ijfatigue.2017.08.010](https://doi.org/10.1016/j.ijfatigue.2017.08.010).
- I. Khader**, A. Renz, A. Kailer, A Wear Model for Silicon Nitride in Dry Sliding Contact against a Nickel-Base Alloy, *Wear* (2017) 376-377 352-362. DOI: [10.1016/j.wear.2016.12.019](https://doi.org/10.1016/j.wear.2016.12.019).
- R. Raga, **I. Khader**, Z. Chlup, A. Kailer, Experimental and numerical investigation of crack initiation and propagation in silicon nitride ceramic under rolling and cyclic contact, *Journal of Physics: Conference Series* (2017) 843(1). DOI: [10.1088/1742-6596/843/1/012030](https://doi.org/10.1088/1742-6596/843/1/012030).
- I. Khader**, S. Rasche, T. Lube, R. Raga, U. Degenhardt, A. Kailer, Lifetime Prediction of Ceramic Components - A Case Study on Hybrid Rolling Contact, *Engineering Fracture Mechanics* (2017) 169 292-308. DOI: [10.1016/j.engfracmech.2016.10.014](https://doi.org/10.1016/j.engfracmech.2016.10.014).
- R. Raga, **I. Khader**, Z. Chlup, A. Kailer, Damage initiation and evolution in silicon nitride under non-conforming lubricated hybrid rolling contact, *Wear* (2016) 360-361 147-159. DOI: [10.1016/j.wear.2016.05.005](https://doi.org/10.1016/j.wear.2016.05.005).
- A. Renz, **I. Khader**, A. Kailer, Tribochemical wear of cutting-tool ceramics in sliding contact against a nickel-base alloy, *Journal of the European Ceramic Society* (2016) 36(3) 705-717. DOI: [10.1016/j.jeurceramsoc.2015.10.032](https://doi.org/10.1016/j.jeurceramsoc.2015.10.032).
- J. Ruck, Y. Othmani, T. Lube, **I. Khader**, A. Kailer, T. Böhlke, Macroscopic damage modeling for silicon nitride, Proceedings in Applied Mathematics and Mechanics PAMM (2015) 15 147-148. DOI: [10.1002/pamm.201510064](https://doi.org/10.1002/pamm.201510064).
- T. Lube, **I. Khader**, A. Kailer, U. Degenhardt, K. Berroth, Ermüdungsbruch in Siliziumnitrid, in Svea Mayer, Michael Panzenböck, Helmut Clemens (Eds.), Praktische Metallographie Sonderband, INVENTUM GmbH, Bonn, 2014, ISBN 978-3-88355-403-7, 353-357.
- C. von der Wehd, T. Lube, **I. Khader**, A. Kailer, U. Degenhardt, K. Berroth, Zyklische Ermüdung technischer Keramiken in wässrigen Medien, in Hans-Jürgen Christ (Ed.), Fortschritte in der Werkstoffprüfung für Forschung und Praxis, Verlag Stahleisen GmbH, Düsseldorf, 2013, ISBN 978-3-514-00806-9, 379-384.
- I. Khader**, D. Kürten, A. Kailer, Modeling of wear in silicon nitride in rolling-sliding contact. Proc. 5<sup>th</sup> World Tribology Congress 2013, Sept. 8–13, 2013, Turin, ISBN 978-88-908185-09.
- N. Winzer, **I. Khader**, Hydrogen diffusion and trapping in bodies undergoing rolling contact, *Wear* (2013) 303(1-2) 451-458. DOI: [10.1016/j.wear.2013.03.042](https://doi.org/10.1016/j.wear.2013.03.042).

- I. Khader**, A. Renz, A. Kailer, D. Haas, Thermal and corrosion properties of silicon nitride for copper die casting components, *Journal of the European Ceramic Society* (2013) 33(3) 593-602. DOI: [10.1016/j.jeurceramsoc.2012.10.005](https://doi.org/10.1016/j.jeurceramsoc.2012.10.005).
- I. Khader**, D. Kürten, A. Kailer, A study on the wear of silicon nitride in rolling–sliding contact. *Wear* (2012) 296(1-2) 630-637. DOI: [10.1016/j.wear.2012.08.010](https://doi.org/10.1016/j.wear.2012.08.010).
- M. Härtelt, H. Riesch-Oppermann, **I. Khader**, O. Kraft, Probabilistic lifetime prediction for ceramic components in rolling applications. *Journal of the European Ceramic Society* (2012) 32(10) 2073-2085. DOI: [10.1016/j.jeurceramsoc.2012.01.009](https://doi.org/10.1016/j.jeurceramsoc.2012.01.009).
- I. Khader**, D. Kürten, A. Kailer, P. Gumbsch, Drahtwalzen mit Werkzeugen aus Siliziumnitrid, in A. Albers and J. Schneider (Ed.), Abschlusskolloquium Sonderforschungsbereich 483, 25. October 2011, Karlsruhe, KIT Scientific Publishing, ISBN 978-3-86644-753-0, pp. 5-16.
- I. Khader**, A. Hashibon, J.-M. Albina, A. Kailer: Wear and corrosion of silicon nitride rolling tools in copper rolling. *Wear* (2011) 271(9-10) 2531-2541. DOI: [10.1016/j.wear.2010.12.071](https://doi.org/10.1016/j.wear.2010.12.071).
- I. Khader**, Damage mechanisms in silicon nitride rolling tools applied in caliber rolling copper and steel wires, PhD Thesis, Karlsruhe Institute of Technology, Shaker Verlag, 2010, ISBN 978-3-8322-9389-5.
- I. Khader**, A. Kailer: Damage mechanisms in silicon nitride wire-rolling tools: Lab-scale experiments and correlation with finite element modeling. *Journal of Materials Processing Technology* (2010) 210 (10) 1314-1325. DOI: [10.1016/j.jmatprotec.2010.03.021](https://doi.org/10.1016/j.jmatprotec.2010.03.021).
- I. Khader**, A. Kailer: Silicon nitride wire rolling tools: Damage analysis and correlation with rolling-contact fatigue. In Bučko, M.M., Haberko, K., Pędzich, Z., Zych, L. (Eds.) Proc. 11<sup>th</sup> European Ceramic Society Conference 2009, Cracow, ISBN 978-83-60958-54-4, CD-ROM, pp. 74-83.
- I. Khader**, S. Fünfschilling, A. Kailer, R. Oberacker: The Behavior of silicon nitride tools in hot rolling copper wire, in A. Fischer and K. Bobzin (Ed.), Friction, Wear and Wear Protection, Wiley-VCH 2009. DOI: [10.1002/9783527628513.ch48](https://doi.org/10.1002/9783527628513.ch48).
- I. Khader**, A. Kailer, P. Gumbsch: Modelluntersuchungen zum Drahtwalzen mit keramischen Walzwerkzeugen, in K.H. Zum Gahr and J. Schneider (Ed.), 3. Statuskolloquium SFB483, 2007, 95-103, ISBN 978-3-933733-00-9.
- I. Khader**, P. Gumbsch, A. Kailer: Damage mechanisms of silicon nitride rolls in hot rolling of copper wire, Proc. Tribologie-Fachtagung, Göttingen 2007, ISBN 978-3-00-022603-8, 73/1-14.

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## RECENT PARTICIPATION IN CONFERENCES

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- 97<sup>th</sup> DKG Annual Meeting, Keramik 2022/Ceramics 2022, (symposium co-organizer and reviewer)
- Materials Week 2021, Online Conference (video presentation)
- Bearing World 2020, Online Conference (presentation)
- Materials Science and Engineering 2014 (MSE 2014), Darmstadt, Germany (symposium co-organizer and reviewer, and presentation)

## AWARDS AND FELLOWSHIPS

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Werkstoffmechanik-Preis recognition award of the Plansee Group and Fraunhofer Institute for Mechanics of Materials IWM, 2011, for PhD Dissertation “Damage mechanisms in silicon nitride rolling tools applied in caliber rolling copper and steel wires”

Sonderforschungsbereich SFB483 Research Fellowship 2006-2012, German Research Foundation (DFG)

## TECHNICAL SKILLS

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### **Finite Element Method (FEM) Modeling**

Specialized in contact analysis and thermomechanical analysis using ABAQUS/Explicit® and ABAQUS/Standard®

### **Finite Element Pre-Processing and Post-Processing**

HyperMesh® and ABAQUS/CAE®

### **Computational Mathematics and Visualization Packages**

MATLAB® and Simulink®

### **Basic Computer Applications**

Fortran and Python programming

### **Measurements and Analytical Techniques**

Digital microscopy and profilometry

Scanning Electron Microscopy (SEM)/Energy Dispersive X-Ray (EDX) spectroscopy

## LANGUAGE SKILLS

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**Arabic:** Mother tongue

**English:** Professional level

**German:** Fluently spoken and very good professional command

**French:** Basic knowledge

## PROFESSIONAL MEMBERSHIPS

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July 2003 – Present

### **Member of the Jordan Engineers Association**

August 2006 – Dec. 2011

**Member of the Collaborative Research Center** “Sonderforschungsbereich SFB483, DFG: High performance sliding and friction systems based on advanced ceramics”, Karlsruhe Institute of Technology KIT