

## Tomas Grejtak

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### EDUCATION

Lehigh University	Mechanical Engineering and Mechanics	Ph.D.	2022
Lehigh University	Mechanical Engineering and Mechanics	M.E.	2019
Midwestern State University	Mechanical Engineering	B.S.	2016

### PROFESSIONAL HISTORY

Postdoctoral Research Associate, Oak Ridge National Laboratory, Oak Ridge, TN 2021-Present

- Machinery wear in biomass preprocessing.
- Eco-friendly, energy-efficient lubrications using nano additives.
- Friction surfaces in heavy vehicle disc brakes.

Research Internship, Argonne National Laboratory, Lemont, IL, USA 2021

- Bearing failure analysis for wind turbines.
- Designing fretting wear tester for wind turbine applications.
- Synchrotron X-ray tomography to investigate cracking in enamel dental tissues.

Graduate Research Assistant, Florida State University, Tallahassee, FL 2020 - 2021

- Wear resistant conductive TiVN, TiMoN and MoS<sub>2</sub> thin films made by PE-ALD for NEMS & MEMS applications.
- Low friction MoS<sub>2</sub> coatings for space applications.

Graduate Research Assistant, Lehigh University, Bethlehem, PA 2016 - 2021

- Evolution-structure-property relationships of tissues in slicing and grinding dentitions (Ph.D. dissertation).
- Contact mechanics of soft materials (hydrogel, PDMS).
- Wear-resistant epoxy nanocomposites made by additive manufacturing.
- Wear modeling and surface topology optimization for improved wear of bi-material surfaces.

### AWARDS

- *NSF INTERN Fellowship*, Research internship at Argonne National Laboratory. 2020
- *Doctoral Travel Grant for Global Opportunities*, International travel grant, Lehigh University. 2020
- *STLE-Philadelphia Section Scholarship*, Contribution to the field of tribology. 2019
- *Student Poster Competition "Silver Award"*, STLE annual meeting, Nashville, TN. 2019
- *Student Research Paper Competition, 3rd Place*, Midwestern State University. 2016
- *NCAA Academic All-American*, Midwestern State University. 2015

### PUBLICATIONS

- 1) **Grejtak, T.**; Wang, S.; Shao, J. Modeling of a Blast Furnace with Both CFD and Thermodynamics Principles. Appl. Mech. 2022, 3, 1019–1039. <https://doi.org/10.3390/applmech3030057>
- 2) **Grejtak, T.**, "Evolution-structure-property-relationships of tissues drive functionality in slicing and grinding dentitions". Dissertation thesis. Lehigh University. January 2022.
- 3) Babuska, T.F., Curry, J.F., Dugger, M.T., Lu, P., Xin, Y., Klueter, S., Kozen, A.C., **Grejtak, T.**, Krick, B.A., "Role of environment on the Shear-Induced Structural Evolution of MoS<sub>2</sub> and impact on oxidation and tribological properties for space applications", ACS Applied Materials & Interfaces, 2022. doi.org/10.1021/acsami.1c24931
- 4) Chowdhury, M.I., Sowa, M., Van Meter, K.E., Babuska, T.F., **Grejtak, T.**, Kozen, A.C., Krick, B.A., Strandwitz, N.C., "Plasma-enhanced atomic layer deposition of titanium molybdenum nitride: Influence of RF bias and substrate structure." J. of Vacuum Science & technology A: Vacuum, Surfaces, and Films, 2021. doi.org/10.1116/6.0001175
- 5) **Grejtak, T.**, Jia, X., Cuniffe, A.R., Shi, Y., Babuska, T.F., Pack, R.C., Vermaak, N., Compton, B.G., Krick, B.A., "Whiskers Orientation controls wear of 3D-printed nanocomposites". Additive Manufacturing. 2020. DOI: 10.1016/j.addma.2020.101515
- 6) Jia, X., **Grejtak, T.**, Krick, B.A., Vermaak, N., "Topology optimization of tribological composites for multifunctional performance at sliding interfaces". Composites Part B. 2020. DOI: 10.1016/j.compositesb.2020.108209
- 7) **Grejtak, T.**, Jia, X., Feppon, F., Joynson, S.G., Cuniffe, A.R., Shi, Y., Kauffman, D.P., Vermaak, N., Krick, B.A., "Topology optimization of composite materials for wear: a route to multifunctional materials for sliding interfaces". Advanced Engineering Materials. 2019. DOI: 10.1002/adem.201900366

- 8) Wang, S., Rowland, L., Elsharafi, M., Ermila, M.A., **Grejtak, T.**, Taylor, C.A., "On leakage issues of sucker rod pumping systems". Journal of Fluids Engineering. 2019. DOI: 10.1115/1.4043500
- 9) Jia, X., **Grejtak, T.**, Krick, B., & Vermaak, N., "Experimentally Calibrated Abrasive Sliding Wear Model: Demonstrations for Rotary and Linear Wear Systems". Journal of Applied Mechanics. 2018. DOI: 10.1115/1.4041470
- 10) Jia, X., **Grejtak, T.**, Krick, B.A., and Vermaak, N., "Design of Composite Systems for Rotary Wear Applications". Materials & Design. 2017. DOI: 10.1016/j.matdes.2017.08.051
- 11) Wang, S., **Grejtak, T.**, and Moody, L.J., "Structural Designs with Considerations of both Material and Structural Failures". ASCE Structural Design and Construction. 2017. DOI: 10.1061/(ASCE)SC.1943-5576.0000314

## PRESENTATIONS

### Conference Presentations:

- 1) **Grejtak, T.**, Lacey, J.A., Kuns, M.W., Hartley, D.S., Thompson, D.N., Fenske, G., Ajayi, O.O., Blau P.J., Qu, J., "Enhancing performance and durability of a knife mill for biomass preprocessing by applying advanced blade materials". 10th Annual Oak Ridge Postdoctoral Association Research Symposium, Oak Ridge, TN. July 14, 2022
- 2) **Grejtak, T.**, Hunt, T., Babuska, T.F., Hendricks, S.K., Norell, M.A., Varma, S., Pathak, S., Erickson, G.M., Krick, B.A., "Evolution-structure-property-relationships of tissues drive functionality in slicing and grinding dentitions". STLE Annual Meeting & Exhibition. Orlando FL, May 18, 2022.
- 3) **Grejtak, T.**, Lacey, J.A., Kuns, M.W., Hartley, D.S., Thompson, D.N., Fenske, G., Ajayi, O.O., Blau P.J., Qu, J., "Understanding and mitigation of knife mill wear in biomass preprocessing". STLE Annual Meeting & Exhibition. Orlando FL, May 16, 2022.
- 4) Van Meter, K., Ramos, D., Lazarte, S., Chowdhury, I., **Grejtak, T.**, Babuska, T.F., Sowa, M.J., Kozen, A.C., Strandwitz, N.C., Krick, B.A., "Probing process-structure-property relationship of ultralow wear plasma enhanced atomic layer deposited nitrides". STLE Annual Meeting & Exhibition. Orlando FL, May 18, 2022.
- 5) Babuska, T.F., **Grejtak, T.**, Curry, J.F., Dugger, M.T., Kozen, A.C., Klueter, S., Ramos, D., Van Meter, K., Krick, B.A., "Role of Environment on the Shear Driven Structural Evolution of MoS<sub>2</sub> and Impact on Aging". STLE Annual Meeting & Exhibition. Orlando FL, May 16, 2022
- 6) **Grejtak, T.**, Hunt, T., Babuska, T.F., Hendricks, S.K., Norell, S., Pathak, S., Erickson, G.M., Krick, B.A., "Evolution-structure-property relationships of damage tolerant horse enamel". Enamel 10 Conference. Pittsburg, PA. May 8, 2022.
- 7) Varma, S., Lee, T.Y., Johnson, S., Harlow, G., Devaraj, A., **Grejtak, T.**, Krick, B.A., Hunt, T.C., Erickson, G.M., Jain, M., Casari, D., Groetsch, A., Kochetkova, t., Schwiedrzik, J., Michler, J., Remund, S., Pathak, S., "Micromechanical and microstructural studies of a unique enamel in the grinding dentition of hadrosaurid dinosaurs." Enamel 10 Conference. Pittsburg, PA. May 8, 2022.
- 8) Hunt, **Grejtak, T.**, Kodangal, D., Varma, S., Rinaldi, C.E., Pathak, S., Krick, B.A., Erickson, G.M., "Selected to fail: how differential fracture mechanics in beaver incisor enamel promote occlusal sharpness". Enamel 10 Conference. Pittsburg, PA. May 8, 2022.
- 9) **Grejtak, T.**, Babuska, T.F., Van Meter, K., Haik, J., Chowdhury, I., Sowa, M.J., Kozen, A.C., Strandwitz, N.C., Krick, B.A., "Ultralow wear of Plasma Enhanced Atomic Layer Deposited Nitrides: Exploring Processing, Structure, Properties and Mechanisms at Multiple Scales". STLE Annual Meeting & Exhibition - virtual conference. May 18, 2021,
- 10) **Grejtak, T.**, Hunt, T., Babuska, T.F., Hendricks, S.K., Norell, M.A., Varma, S., Pathak, S., Erickson, G.M., Krick, B.A., "Paleo-tribology: Inspiration from Fossil Grinding Dentitions; From Wear Models to Damage Tolerant Composites". STLE Annual Meeting & Exhibition - virtual conference. May 18, 2021.
- 11) **Grejtak, T.**, Babuska, T.F., Van Meter, K., Haik, J., Chowdhury, I., Sowa, M.J., Kozen, A.C., Strandwitz, N.C., Krick, B.A., "Ultralow wear of Plasma Enhanced Atomic Layer Deposited Nitrides: Exploring Processing, Structure, Properties and Mechanisms at Multiple Scales". STLE Annual Meeting & Exhibition - virtual conference. May 18, 2021,
- 12) Babuska, T.F., Curry, J.F., **Grejtak, T.**, Krick, B.A., "Probing the influence of Water and Oxygen on the Friction and Wear of MoS<sub>2</sub>". STLE Annual Meeting & Exhibition - virtual conference. May 17, 2021,
- 13) **Grejtak, T.**, Babuska, T.F., Hendricks, S.K., Norell, M.A., Varma, S., Pathak, S., Erickson, G.M., Krick, B.A., "Remarkable wear and fracture properties and unique 3D-microstructure of enamel in the dentition of the hadrosaurid dinosaur". STLE Annual Meeting & Exhibition, May 14, 2020, virtual conference
- 14) Erickson, G.M., Hunt, T., Hendrick, S.K., Pathak, S., Varma, S., Babuska, T.F., **Grejtak, T.**, Krick, B.A., "Complex dental structure and wear biomechanics in non-avian dinosaurs and Pleistocene mammals". The FASEB journal, April 20, 2020

- 15) Jia, X., **Grejtak, T.**, Krick, B.A., Vermaak, N., "Designing tribological composites for multifunctional performance at sliding interfaces". 2016 ASME IMECE, Phoenix AZ, November 14, 2019
- 16) Seims, K.B., Camacho, P., Schwarzenberg, P., Babuska, T.F., **Grejtak, T.**, De Long, W.G., Krick, B.A., Dailey, H.L., Chow, L.W., "Strategies to Tune Physical Properties in 3D-Printed Biomaterials", Biomedical Engineering Society. BMES Annual Meeting, Philadelphia, PA, October 16-19, 2019
- 17) **Grejtak, T.**, Babuska, T.F., Jia, X., Pathak, S., Jain, Manish., Lee, Y.T., Hendricks, S.K., Erickson, G.M., Krick, B.A. "Biomechanics of Hierarchically-Structured Enamel in Grinding Dentitions: A Route to Multifunctional Materials for Sliding Interfaces". STLE Annual Meeting & Exhibition. Nashville, TN. May 15, 2019
- 18) Atkinson, C.C., Sidebottom, M.A., Babuska, T.F., Grejtak, T., Balsamo, B., Campbell, K. L., Junk, C.P., Burch, H.E., Krick, B.A., "Nanomechanics of Ultralow Wear PTFE-Based Composites: Microstructure and Mechanics of Filler Particles". STLE Annual Meeting & Exhibition. Nashville, TN. May 16, 2019
- 19) Jia, X., **Grejtak, T.**, Krick, B.A., Vermaak, N., "Topology Optimization of Tribological Composites for Multifunctional Applications". World Congress of Structural and Multidisciplinary Optimization. Beijing, China. May 20-24, 2019.
- 20) **Grejtak, T.**, Babuska, T.F., Jia, X., Krick, B.A., "Modified Winkler Model for Micro-indentation". STLE Annual Meeting & Exhibition. Minneapolis, MN. May 16, 2018
- 21) Jia, X., **Grejtak, T.**, Krick, B.A., Vermaak, N., "Modelling Sliding Abrasive Wear of Bi-material Composites". STLE Annual Meeting & Exhibition. Minneapolis, May 15, 2018.
- 22) Jia, X., **Grejtak, T.**, Krick, B.A., Vermaak, N., "Topology Optimization for Abrasive Sliding Wear of Bi-material composites". TMS 147th Annual Meeting and Exhibition, Phoenix, March 11-15, 2018.
- 23) Jia, X., **Grejtak, T.**, Krick, B.A., Vermaak, N., "Modelling Abrasive Sliding Wear for Composite Systems". 54th Annual Technical Meeting of the Society of Engineering Science (SES), Boston, July 25-28, 2017
- 24) Jia, X., **Grejtak, T.**, Krick, B.A., Vermaak, N., "Design of Polymer-based Composite Systems for Wear Applications". Emulsion Polymers Institute (EPI) Annual Review Meeting, Lehigh, June 2, 2017.
- 25) **Grejtak, T.**, Jia, X., Sidebottom, M.A., Feppon, F., Krick, B.A., and Vermaak, N., "Design of Composite Systems for Rotary Wear Applications". STLE Annual Meeting & Exhibition. Atlanta, GA. May 24, 2017
- 26) Jia, X., Sidebottom, M.A., **Grejtak, T.**, Feppon, F., Krick, B.A., Vermaak, N., "Design of Composite Systems for Wear Performance". 2016 ASME IMECE, Phoenix AZ, November 11-17, 2016.
- 27) **Grejtak, T.**, Wang, S., "Monitoring and Improving a Combustion Chamber of a Blast Furnace with Thermodynamics and Computational Fluid Dynamics". International Conference in Computational Methods. Berkeley, CA. August 9, 2016.

#### Spotlight Presentation:

**Grejtak, T.**, Babuska, T.F., Hendricks, S.K., Norell, M.A., Lee, Y.T., Varma, S., Pathak, S., Erickson, G.M., Krick, B.A., "Evolutionary Routes to Damage Tolerant Materials: Dentition of Grinding Animals in the Fossil Record". STLE Frontiers, Chicago IL, November 19, 2019

#### Invited Presentation:

**Grejtak, T.**, Babuska, T.F., Hendricks, S.K., Norell, M.A., Lee, Y.T., Varma, S., Pathak, S., Erickson, G.M., Krick, B.A., "The Role of Multiscale Organization and Structure of Dental Tissues in the Wear and Fracture of Grinding Dentitions in Grazing Animals". STLE Philadelphia Section. Philadelphia, PA. January 16, 2020.

#### Poster Presentations:

- 1) **Grejtak, T.**, Hunt, T., Babuska, T.F., Hendricks, S.K., Norell, M.A., Varma, S., Pathak, S., Erickson, G.M., Krick, B.A., "Nature's solution to wear and fracture resistance in hard and brittle enamel". Gordon Research Conference, Lewiston, ME. June 28, 2022.
- 2) **Grejtak, T.**, Lacey, J.A., Kuns, M.W., Hartley, D.S., Thompson, D.N., Fenske, G., Ajayi, O.O., Blau P.J., Qu, J., "Applying advanced blade materials to improve knife milling performance for biomass preprocessing". FCIC Annual Meeting, June 9, 2022.
- 3) **Grejtak, T.**, Jia, X., Feppon, F., Joynson, S.G., Cuniffe, A.R., Shi, Y., Kauffman, D.P., Vermaak, N., Krick, B.A., "Topology Optimization of Composite Materials for Wear: A Route to Multifunctional Materials for Sliding Interfaces". STLE Annual Meeting & Exhibition. Nashville, TN. Student Poster Competition "Silver Award". May 15, 2019
- 4) Jia, X., **Grejtak, T.**, Krick, B.A., Vermaak, N., "Design of Tribological Composites for Multi-functional Applications". 2018 ASME IMECE (The American Society of Mechanical Engineers' International Mechanical Engineering Congress and Exposition). Pittsburgh, PA November 11-14, 2018
- 5) Joynson, S.G., **Grejtak, T.**, Jia, X., Cuniffe, A.R., Feppon, F., Krick, B.A., Vermaak, N., "Experimental Validation of Topology Optimized Composites for Wear". 2017 ASME IMECE, Tampa, FL November, 2018
- 6) Jia, X., **Grejtak, T.**, Krick, B.A., Vermaak, N., "Design of Composite Systems for Rotary Wear Applications". Society of Tribologists and Lubrication Engineers, Atlanta GA, May 21-25, 2017.

- 7) **Grejtak, T.**, Sedaille, M.D., Curry, J.F., Krick, B.A. "Optical In Situ Micro Tribometer for Analysis of Real Contact Area for Adhesive Contact Mechanics". Society of Tribologists and Lubrication Engineers. Atlanta, GA. May 21-25, 2017.

## TEACHING EXPERIENCE

- *Materials Tribology*, 5 lectures, Florida State University 2020
- *Mechanical Engineering Elements*, teaching assistant, Lehigh University 2018-2019
- *Teacher Development Series*, Level I and II certification, Lehigh University 2016

## PROFESSIONAL ASSOCIATION AND SERVICE

- *Tribology Transactions*, Journal reviewer 2021 – Present
- *Journal of Tribology*, Journal Reviewer 2022
- *ACS Applied Nanomaterials*, Journal Reviewer 2022
- *Friction*, Journal reviewer 2022
- *Biotribology*, Journal reviewer 2022
- *Computer Methods in Biomechanics and Biomedical Engineering*, Journal reviewer 2022
- *Society of Tribologists and Lubrication Engineers (STLE)*, Member 2016 – Present
- *STLE Annual Meeting*, Materials Tribology, Session Chair 2021
- *STLE Annual Meeting*, Materials Tribology, Session Co-Chair 2019
- *ASTM Committee G2 on Wear and Erosion*, Member 2022

## RESEARCH PROPOSALS

- *Synchrotron beam time*, Micro-tomography, **Grejtak T (PI)**, Krick B.A. (co-PI), APS, Lemont, IL 2021
- *Synchrotron beam time*, Nano-tomography, **Grejtak T. (PI)**, Gould B. (co-PI), APS, Lemont, IL 2021
- *Synchrotron beam time*, Photoemission electron microscopy, **Grejtak T. (PI)**, Krick B.A (co-PI), Babuska T. (co-PI), NSLS-II, Upton, NY 2020, 2021

## COMMUNITY INVOLVEMENT AND OUTREACH

- *ASM Camp*, Demonstration of principles of tribology to high school students, Lehigh University. 2017, 2018
- *STLE STEM Camp*, Tutorials about the importance of friction, wear, and lubrication for high school students, STLE Annual Meetings. 2017, 2018