ALI ERDEMIR

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Halliburton Chair in Engineering Professor
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CAREER HIGHLIGHTS:

Over the past three decades, Dr. Erdemir has distinguished himself as a pioneering scientist in tribology, mechanical engineering, materials science, energy, the environment, and related disciplines. His multidisciplinary research has led to key discoveries, recognized with numerous awards, honors, and patents. His international reputation as a leading scientist culminated in his presidency of the International Tribology Council (ITC) in 2017. He also served as president of the Society of Tribologists and Lubrication Engineers (STLE) – USA in 2016-2017. He is the 2024 recipient of the Tribology Gold Medal, the highest honor in the field, awarded annually by the Tribology Trust Awards Committee under the auspices of the Institution of Mechanical Engineers, London. He is an elected member of the National Academy of Engineering (since 2019), a Fellow of the National Academy of Inventors (since 2022), a Foreign Fellow of the European Academy of Sciences (since 2024), and a member of the European Academy of Sciences and Arts (since 2022), the World Academy of Ceramics (since 2021), and the Science Academy of Turkey (since 2021). He received an Honorary Doctorate from his alma mater, Istanbul Technical University, in 2024. In 2020, he joined the Mechanical Engineering Department at Texas A&M University, initially as a TEES Eminent Professor, subsequently as the Halliburton Chair in Engineering, and then as the University Distinguished Professor to establish a cutting-edge tribology research laboratory. His current research focuses on the nanoscale design and large-scale manufacturing of novel materials, coatings, and lubricants for diverse industrial applications in manufacturing, transportation (including e-mobility), and other energy conversion and utilization systems to advance efficiency, reliability, and environmental sustainability. His publications have garnered over 37,000 citations (Google h-index: 89, i10-index: 269 as of March 2025).

EDUCATION:

- Ph.D. Materials Science and Engineering, Georgia Institute of Technology, 1986
- M.S. Materials Science and Engineering, Georgia Institute of Technology, 1982
- B.S. Metallurgical Engineering, Istanbul Technical University, Turkey, 1977

EMPLOYMENT HISTORY:

Texas A&M University, J. Mike Walker '66 Department of Mechanical Engineering, College Station, TX-USA

- University Distinguished Professor, since January 2025
- Halliburton Chair in Engineering Professor, since September 2020
- TEES Eminent Professor, February 2020 - September 2020
- Affiliated Faculty, Materials Science and Engineering, since 2021

Argonne National Laboratory, Argonne Illinois-USA

- Argonne Laboratory Emeritus Scientist Argonne National Laboratory, 2020-present
- Argonne Distinguished Fellow Applied Materials Division, 2010 to 2020

Georgia Institute of Technology, Atlanta, Georgia-USA

- Post-Doctoral Fellow, Department of Materials Science and Engineering, 1986-1987.

SELECTED HONORS AND AWARDS:

National/International Recognitions:

- **Tribology Gold Medal** (highest honor in tribology), Tribology Trust Awards Committee/Institution of Mechanical Engineers, London, 2024.
- **Elected Fellow,** European Academy of Sciences, 2024
- **Elected Fellow,** National Academy of Inventors-USA, 2022
- **Elected Member,** European Academy of Sciences and Arts, 2022
- **Elected Member,** The Science Academy of Turkey, 2021
- **Elected Professional Member,** World Academy of Ceramics, 2021
- **Elected Member,** National Academy of Engineering, 2019
- **Elected Member,** The Academy of Medicine, Engineering and Science of Texas, 2020
- **Medal of Distinguished Performance at Argonne National Laboratory,** The University of Chicago, 2011 (The **highest honor** at Argonne)
- **Argonne Distinguished Fellow** (the **highest scientific or engineering rank** at the Laboratory), 2010-2020
- **R&D 100 Awards** (internationally recognized as the "**Oscars of Innovation**" it has been awarded for the best innovations in the world in a given year since 1962).
    - **R&D-100 Award (**for the development of "Versatile Hard Carbon Microspheres Made from Plastic Waste"), R&D Magazine, 2015
    - **R&D-100 Award,** (for the development of "Ultra-fast and Large-scale Boriding), R&D Magazine, 2012
    - **R&D 100 Award** (for the development of superhard and slick coatings), R&D Magazine, 2009
    - **R&D 100 Award** (for the development of nano-structured carbide-derived carbon films), R&D Magazine, 2003
    - **R&D 100 Award** (for the development of nearly-frictionless carbon films), R&D Magazine, 1998
    - **R&D 100 Award** (for the discovery of boric acid as a solid lubricant), R&D Magazine, 1991

    - **R&D 100 Awards Finalists,** (for the development of a catalytic upcycling process that converts plastic wastes to high-performance lubricants), 2022.
- **Discover Magazine Award** (for the discovery of nearly-frictionless carbon), 1998
- **Honorary Doctorate,** Istanbul Technical University, Istanbul, Turkey, 2024
- **Distinguished Engineering Alumni Award**, Georgia Institute of Technology, 2000
- **Honorary Doctorate Degree**, Anadolu University, Eskisehir, Turkey, 1998.

Professional Society Honors and Awards:

- **Honorary Member,** American Society of Mechanical Engineers, 2023 (in recognition of lifetime achievement in mechanical engineering)
- **Tribochemistry Medal,** Japanese Society of Tribologists, 2023 (the **highest honor recognizing sustained and outstanding contributions** to the field of tribochemistry).
- **STLE International Award,** Society of Tribologists and Lubrication Engineers, 2020 (the Society's **highest technical honor**).
- **Distinguished Tribologists Award,** Japanese Society of Tribologists, 2020 (the **Society's highest technical honor** given for the first time to a foreign national).
- **President,** International Tribology Council, 2017-2022
- **President,** Society of Tribologists and Lubrication Engineers, 2016-2017.
- **Mayo D. Hersey Award,** American Society of Mechanical Engineers-International, 2015
- **Al Sonntag Award**, Society of Tribologists and Lubrication Engineers, 2002
- **Allan A. Manteuffel Award**, Society of Tribologists and Lubrication Engineers, Chicago Section, 2002
- **Edmond E. Bisson Award**, Society of Tribologists and Lubrication Engineers, 1998
- **Al Sonntag Award,** Society of Tribologists and Lubrication Engineers, 1992
- **Innovative Research Award**, Tribology Division of the American Society of Mechanical Engineers-International, 1999
- **Life Member,** ASM-International, since 2019
- **Honorary Member,** Society of Tribologists and Lubrication Engineers, 2020 (for sustained and outstanding contributions in tribology, lubrication engineering, or allied fields)
- **Life Member,** Society of Tribologists and Lubrication Engineers, since 2017.
- **Fellow,** American Association for the Advancement of Science, (AAAS), 2018
- **Fellow**, American Society of Mechanical Engineers, 2010
- **Fellow**, American Vacuum Society, 2010
- **Fellow,** Society of Tribologists and Lubrication Engineers, 2003
- **Fellow,** American Society for Metals (ASM) International, 2001
- **Member, Board of Directors**, Society of Tribologists and Lubrication Engineers (STLE), 2005 to 2012.
- **Chair**, American Vacuum Society (AVS), Advanced Surface Engineering Division, 2010.

- **Secretary, Treasurer, and Vice-Chair**, ASME-International, Tribology Division, 2008 to 2010.

PROFESSIONAL AFFILIATIONS:

- American Society of Mechanical Engineers-International (ASME-Int.), since 1993 (Honorary Member, 2023; Fellow, 2010)
- American Association for the Advancement of Science, (AAAS), since 2013 (Fellow, 2018)
- Society of Tribologists and Lubrication Engineers (STLE), since 1989 (Honorary Member, 2020; Fellow, 2003)
- American Society for Metals-International, since 1980 (Fellow, 2001)
- American Vacuum Society, since 1988 (Fellow, 2010)
- Georgia Tech Alumni Association, since 1987
- The Metallurgical Society, 1985-2000

RESEARCH AREAS AND EXPERTISE:

Dr. Erdemir has made significant contributions to materials science, mechanical engineering, surface engineering, lubrication, and tribology. His expertise spans a wide range of areas, including:

- Nano-structured and composite materials and coatings
- Physical and chemical vapor deposition
- Solid/liquid lubrication and nano-lubrication
- Superlubricity and tribochemistry
- Surface science and tribocatalysis
- Waste-plastic derived lubricants and their tribology
- Diamond and diamond-like carbon films
- Self-lubricating composites
- Electric vehicle tribology
- Low-dimensional materials and coatings

His outstanding contributions to these fields have resulted in numerous discoveries, patents, and publications that have advanced our understanding of the fundamental friction and wear mechanisms of novel materials, coatings, and lubricants.

SELECTED PUBLICATIONS AND PATENTS:

Books:

1. P. Lee, L. Farfan-Cabrera, A. Erdemir, eds., ***Electric Vehicle Fluid Testing***, CRC Press/Taylor & Francis, Boca Raton, FL, USA (in preparation, expected in 2025).
2. L. Farfan-Cabrera, A. Erdemir eds., "***Electric Vehicle Tribology***", Elsevier, Amsterdam, 2024.
3. A. Erdemir, J.-M. Martin, and J. Luo, eds., **"*Superlubricity II*,"** Elsevier, Amsterdam, 2020.
4. S-C. Cha and A. Erdemir, eds., **"*Coating Technology for Vehicle Applications*"** Springer, New York, 2015
5. C. Donnet and A. Erdemir, eds., **"*Tribology of Diamondlike Carbon Films: Fundamentals and Application*s,"** Springer, New York, 2008
6. A. Erdemir and J.M. Martin, eds., **"*Superlubricity*,"** Elsevier, Amsterdam, 2007.

Selected Patents (out of 37):

1. United States Patent # 12,215,292, Catalytic Upcycling of Polyolefins into Lubricants, 2025
2. United States Patent # 11,566,203, Sub-stoichiometric Metal Nitrides, 2023
3. United States Patent # 11,519,507, Graphene Embedded Seal, 2022
4. United States Patent # 11,015,140: Catalytically Active Lubricants, 2021
5. United States Patent # 10,876,200: Pitting Resistant Carbon Coatings, 2020

Selected Invited Book/Handbook Chapters (out of 21):

1. "Tribological challenges for a sustainable e-mobility", S. Lee, J. A. Cao-Romero-Gallegos, L. Farfan-Cabrera, A. Erdemir, in "***Electric Vehicle Tribology***", L. Farfan-Cabrera, A. Erdemir eds., Elsevier, Amsterdam, 2024, pp. 5-21.
2. "Electrified tribotesting of lubricants and materials used in electric vehicle drivelines", L. Farfan-Cabrera, A. Erdemir, J. A. Cao-Romero-Gallegos, O. Aguilar-Rosas, in "***Electric Vehicle Tribology***", L. Farfan-Cabrera, A. Erdemir eds., Elsevier, Amsterdam, 2024, pp 265-276.
3. "Diamondlike carbon films and their superlubricity" *in "**Superlubricity, 2nd ed**."* A. Erdemir, J.-M. Martin, and J. Luo, eds., Elsevier, Amsterdam, pp. 215-229, 2020.
4. "Energy consumption due to friction in motored vehicles and low-friction coatings to reduce it", A. Erdemir and K. Holmberg, in "***Coating Technology for Vehicle Applications***", C. H. Cha and A. Erdemir (Editors), Springer, New York, pp. 1-23, 2015.
5. "Low-friction Materials and Coatings," A. Erdemir, in ***Multifunctional Surfaces and Materials for Tribological Applications***," R. Wood, ed., Pan Stanford Publishing, pp. 259-289, 2015.

Selected Peer-reviewed Journal Articles (out of 253):

1. "Advancing the Frontiers of EV Tribology with 2D Materials – A Critical Perspective", D. Berman, L. Farfan-Cabrera, A. Rosenkranz, A. Erdemir, ***Materials Science and Engineering – R*,** 161 (2024) 100855.
2. "2D materials for durable and sustainable electric vehicles", D. Berman, L. Farfan-Cabrera, A. Rosenkranz, A. Erdemir, ***Nature Reviews Materials***, (2024)1-3.
3. "Operando Tribochemical Formation of Onion-Like-Carbon Leads to Macroscale

Superlubricity", D. Berman, A. Sumant, A. Erdemir, ***Nature Communications***, (2018) 9:1164, DOI: 10.1038/s41467-018-03549-6, 2018.

4. "Carbon-based Tribofilms from Lubricating Oils", A. Erdemir, G. Ramirez, O. Eryilmaz, Y. Liao, B. Narayanan, S. Sankaranarayanan, ***Nature***, 536(2016)67-71.
5. "Macroscale superlubricity enabled by graphene nanoscroll formation", D. Berman, S. A. Deshmukh, S.K.R.S. Sankaranarayanan, A. Erdemir, and A.V. Sumant, ***Science,*** 348(2015)1118-1122.

SELECTED PRESENTATIONS:

Plenary Lectures (out of 41):

1. "Materials and Lubrication Challenges for a Sustainable Electric Vehicle Mobility: Recent Progress and Future Prospects", A. Erdemir, **7th TTRF - TAIHO International Symposium on Automotive Tribology,** Nagoya Congress Center, Nagoya, Japan, April 17, 2024.
2. "Tribological Challenges and Opportunities for a Sustainable E-Mobility", A. Erdemir, **4th International Brazilian Conference on Tribology,** Vittoria, Brazil, November 26-29, 2023.
3. "Vanishing Friction by Bridging Fundamental Principles with Scientific Innovations for Real Engineering Applications", A. Erdemir, **9th International Tribology Conference,** Fukuoka, Japan, September 25-30, 2023.
4. "Tribological Challenges for a Sustainable E-Mobility: Recent Progress and Future Prospects", A. Erdemir, presented at the **IndiaTrib – 2022**, New Delhi, India, 12-14 December 2022, 2022.
5. "Advances in Superlubricity – Recent Developments and Future Prospects (Award Lecture)", A. Erdemir, presented at the **Annual Conference of Japanese Society of Tribologist** (virtual), November 11-13, 2020.

Keynote Lectures (out of 47):

1. "Materials and Lubrication Challenges in Electric Vehicles: Recent Progress and Future Outlook", presented at **LUBMAT-IBERTRIB-2024**, A. Erdemir, Bilbao-San Sebastian, Spain, June 17-20, 2024.
2. "Frontiers of Catalyst-driven Tribochemistry: Implications for Superior Friction and Wear Properties", A. Erdemir, **Tribochemistry-2023**, Beppu-Japan, September 21-24, 2023.
3. "Upcycling Plastics for a More Efficient and Sustainable Lubrication Future," A. Erdemir, presented at the **12th Materials Science and Engineering Symposium**, Doha, Qatar, February 22, 2023.
4. "On the Critical Role of Hydrogen in Superlubricity of Diamondlike Carbon (DLC) Films: Recent Developments and Future Prospects", presented at the **Society of Engineering Science Annual Technical Meeting**, College Station, TX, October 16 - 19, 2022.
5. "A Lifecycle Analysis for the Efficiency and Emission of EVs in Comparison to IC Engines", Ali Erdemir, Leonardo Israel Farfan Cabrera, Kenneth Holmberg, Presented at the

STLE - Tribology and Lubrication for E-Mobility Conference, San Antonio, TX, November 3-5, 2021.

Invited Talks (out of 91):

1. "Tribochemistry of Electrified Interfaces: The Good, the Bad, and the Ugly", A. Erdemir, presented at the **Gordon Research Conference on Tribology**, Lewiston, ME, June 23-28, 2024.
2. "Superlubricity and Superior Wear Resistance of 2D Materials: Recent Developments and Future Prospects", A. Erdemir, presented at the **CIMTEC 2022 - 15th International Ceramics Congress**, Perugia, Italy, June 20-29, 2022.
3. "Frontiers of Superlubricious Carbon Tribofilms Towards a Sustainable and Carbon Neutral Future", A. Erdemir, presented at the **15th International Conference on New Diamond and Nano-Carbons (NDNC)**, Kanazawa, Japan, June 6-9, 2022.
4. "Innovative Surface Technologies for a Green and Sustainable Future", A. Erdemir, presented at the **Green Surface Engineering for Advanced Manufacturing (Green-SEAM) Meeting**, Montreal, Canada, May 13-19, 2021 (held virtually).
5. "Surface Engineering for Ultra-low Friction and Wear: Recent Developments", Ali Erdemir, presented at the **47th International Conference on Metallurgical Coatings and Thin Films,** April 27-May 1, 2020 (held virtually).

Invited Colloquia and Seminars (out of 83):

1. "Catalyst-driven Tribochemistry: A Novel Approach to Achieving Superior Friction and Wear Properties in Lubricated Contacts", A. Erdemir, presented at **Tekniker Research and Technology Center,** Eibar, Bilbao, Spain, June 17, 2024.
2. "Tribological Challenges for a Sustainable E-Mobility: Recent Progress and Future Prospects", presented at the **KTH-Royal Institute of Technology**, Stockholm, Sweden, June 9, 2023.
3. "Frontier Research on Electric Vehicles Tribology-Latest Developments and Future Prospects", A. Erdemir, presented to **Tecnológico de Monterrey**, Puebla, Mexico, March 14, 2023.
4. "Materials and Tribological Challenges for a Sustainable E-Mobility: Recent Developments and Future Prospects", A. Erdemir, presented at the **Mechanical Engineering Department of Texas A&M University at Qatar**, February 20, 2023.
5. "Vanishing Friction: How Close Are We? A Historical Perspective", **Distinguished Lecture** Series presentation to the **University of North Texas, Department of Materials Science and Engineering, Denton**, TX, September 23, 2022.

Conference Presentations (out of 330):

1. "Atomistic Mechanisms of Temperature-Induced Phase Transitions of 2d Lead Halide Perovskite by Molecular Dynamics Simulation," R. Namakian, A. Erdemir, Q. Tu, M. A. Garzon, W. Gao, presented at the ASME 2024 International Mechanical Engineering Congress and Exposition (IMECE2024), Portland, Oregon, November 15-21, 2024.

2. “Alteration of the traction coefficient behavior of lubricants under electrified sliding-rolling conditions,” L. I. Farfan-Cabrera, P. Lee, C. Sanchez, S. J. Lee, A. Erdemir, presented at the 49th Leeds-Lyon Symposium on Tribology, Lyon, France, September 2-4, 2024.
3. “Unraveling the Complex Tribochemistry of Lubricated Surfaces Under Electrified Sliding Conditions”, A. Erdemir, P. Deshpande, C. Yelkarasi, S. Lee, L. Farfan-Cabrera, presented at the 78th Annual Meeting of the Society of Tribologists and Lubrication Engineers, Minneapolis, MN, May 19-23, 2024.
4. “Ultra-Fast Synthesis of High Entropy Boride Layers and Their Characterization,” M. U. Komurlu, A. Erdemir, presented at 2024 MRS Spring Meeting & Exhibit, April, 22-26, 2024.
5. “Mechanical and Structural Characterization of Ultra-fast Boriding Process on Refractory Metals”, M. U. Komurlu; C. M. Ensar Acemi; C. Yelkarasi; A. Erdemir; I. Karaman, presented at the 2024 TMS Annual Meeting & Exhibition, Orlando, Florida, March 3–7, 2024.