

# MEHMET Z. BAYKARA

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## ACADEMIC POSITIONS

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| <b>Visiting Scholar</b><br>Department of Physics<br>Harvard University, Cambridge, USA  | September 2017 –             |
| <b>Assistant Professor</b><br>Department of Mechanical Engineering<br>Bilkent University, Ankara, Turkey                              | September 2012 – August 2017 |
| <b>Research and Teaching Assistant</b><br>Department of Mechanical Engineering & Materials Science<br>Yale University, New Haven, USA | September 2006 – May 2012    |

## EDUCATION

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| <b>Yale University, School of Engineering and Applied Science</b> , New Haven, CT, USA<br>Ph.D. in Mechanical Engineering & Materials Science<br><i>Henry Prentiss Becton Prize for Exceptional Achievement in Research</i> | May 2012  |
| <b>Boğaziçi University</b> , Istanbul, Turkey<br>B.S. ( <i>High Honors</i> ) in Mechanical Engineering, <i>First Rank</i>   | July 2006 |
| <b>Deutsche Schule Istanbul</b> , Istanbul, Turkey<br>ABITUR Diploma, <i>First Rank</i>   | June 2002 |

## AWARDS, SCHOLARSHIPS AND FELLOWSHIPS

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| • <i>Finalist</i> , Gerhard Ertl Young Investigator Award of the DPG                         | 2017      |
| • Junior Chamber International (JCI) Ten Outstanding Young Persons of the World Award (TOYP) | 2016      |
| • Science Academy Association Distinguished Young Scientist Award (BAGEP)                    | 2015      |
| • Turkish Academy of Sciences Outstanding Young Scientist Award (TÜBA-GEBİP)                 | 2014      |
| • FABED Eser Tümen Outstanding Young Scientist Award   | 2014      |
| • METU Prof. Dr. Mustafa Parlar Foundation Research Incentive Award                          | 2013      |
| • Henry Prentiss Becton Prize for Exceptional Achievement in Research                        | 2012      |
| • Materials Research Society (MRS) Graduate Student Award                                    | 2011      |
| • Oak Ridge National Lab Travel Award  | 2010      |
| • American Vacuum Society (AVS) <i>NSTD</i> Best Student Paper Award                         | 2009      |
| • Yale University Edward L. Barlow Endowed Fellowship  | 2007      |
| • Yale University Faculty of Engineering Supplementary Fellowship                            | 2006      |
| • Columbia University Presidential Fellowship ( <i>declined</i> )                            | 2006      |
| • Boğaziçi University High Honors Certificate  | 2006      |
| • Deutsche Schule Istanbul Best Graduating Student Award                                     | 2002      |
| • DAAD Scholarship for Undergraduate Studies in Germany ( <i>declined</i> )                  | 2002      |
| • Deutsche Schule Istanbul Tuition Scholarship   | 1994-2002 |

**JOURNAL PUBLICATIONS**

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1. Ye, Z., Balkanci, A., Martini, A., **Baykara, M.Z.**, *Effect of Roughness on the Layer-Dependent Friction of Few-Layer Graphene*, Physical Review B **96**, 155401 (2017).
2. Abdelwahab, M.T., Kalyoncu, E., Onur, T., **Baykara, M.Z.**, Seker, U.O.S., *Genetically-Tunable Mechanical Properties of Bacterial Functional Amyloid Nanofibers*, Langmuir **33**, 4337-4345 (2017).
3. Cihan, E., İpek, S., Durgun, E., **Baykara, M.Z.**, *Structural Lubricity under Ambient Conditions*, Nature Communications **7**, 12055 (2016).
4. Demirbaş, T. and **Baykara, M.Z.**, *Nanoscale Tribology of Graphene Grown by Chemical Vapor Deposition and Transferred onto Silicon Oxide Substrates*, Journal of Materials Research **31**, 1914-1923 (2016).
5. **Baykara, M.Z.**, Mönig, H., Schwendemann, T.C., Ünverdi, Ö., Altman, E.I., Schwarz, U.D., *Three-Dimensional Interaction Force and Tunneling Current Spectroscopy of Point Defects on Rutile TiO<sub>2</sub>(110)*, Applied Physics Letters **108**, 071601 (2016).
6. Cihan, E., Özoğul, A., **Baykara, M.Z.**, *Structure and Nanotribology of Thermally Deposited Gold Nanoparticles on Graphite*, Applied Surface Science **354**, 429-436 (2015).
7. Uluutku, B. and **Baykara, M.Z.**, *Artifacts Related to Tip Asymmetry in High-Resolution Scanning Tunneling Microscopy and Atomic Force Microscopy Measurements of Graphitic Surfaces*, Journal of Vacuum Science & Technology B **33**, 031802 (2015).
8. Altman, E.I., **Baykara, M.Z.**, Schwarz, U.D., *Noncontact Atomic Force Microscopy: An Emerging Tool for Fundamental Catalysis Research*, Accounts of Chemical Research **48**, 2640-2648 (2015).
9. **Baykara, M.Z.**, Todorovic, M., Mönig, H., Schwendemann, T.C., Rodrigo, L., Altman, E.I., Perez, R., Schwarz, U.D., *Simultaneous Measurement of Multiple Independent Atomic-Scale Interactions Using Scanning Probe Microscopy: Data Interpretation and the Effect of Cross-Talk*, Journal of Physical Chemistry C **119**, 6670-6677 (2015).
10. Karayaylali, P. and **Baykara, M.Z.**, *Analysis of Amplitude Modulation Atomic Force Microscopy in Aqueous Salt Solutions*, Applied Surface Science **318**, 137-141 (2014).
11. Uçar, A., Çopuroglu, M., **Baykara, M.Z.**, Arıkan, O., Suzer, S., *Tribological Interaction between Polytetrafluoroethylene and Silicon Oxide Surfaces*, Journal of Chemical Physics **141**, 164702 (2014).
12. Uluutku, B. and **Baykara, M.Z.**, *Effect of Lateral Tip Stiffness on Atomic-Resolution Force Field Spectroscopy*, Journal of Vacuum Science & Technology B **31**, 041801 (2013).
13. **Baykara, M.Z.**, Todorovic, M., Mönig, H., Schwendemann, T.C., Ünverdi, Ö., Rodrigo, L., Altman, E.I., Perez, R., Schwarz, U.D., *Atom-Specific Forces and Defect Identification on Surface-Oxidized Cu(100) with Combined 3D-AFM and STM Measurements*, Physical Review B **87**, 155414 (2013).

14. Ritter, C., **Baykara, M.Z.**, Stegemann, B., Heyde, M., Rademann, K., Schroers, J., Schwarz, U.D., *Nonuniform Friction-Area Dependency for Antimony Oxide Surfaces Sliding on Graphite*, Physical Review B **88**, 045422 (2013).
15. Mönig, H., Todorovic, M., **Baykara, M.Z.**, Schwendemann, T.C., Rodrigo, L., Altman, E.I., Perez, R., Schwarz, U.D., *Understanding Scanning Tunneling Microscopy Contrast Mechanisms on Metal Oxides: A Case Study*, ACS Nano **7**, 10233-10244 (2013).
16. **Baykara, M.Z.**, Schwendemann, T.C., Albers, B.J., Pilet, N., Mönig, H., Altman, E.I., Schwarz, U.D., *Exploring Atomic-Scale Lateral Forces in the Attractive Regime: A Case Study on Graphite (0001)*, Nanotechnology **23**, 405703 (2012).
17. **Baykara, M.Z.**, Dagdeviren, O.E., Schwendemann, T.C., Mönig, H., Altman, E.I., Schwarz, U.D., *Probing Three-Dimensional Surface Force Fields with Atomic Resolution: Measurement Strategies, Limitations, and Artifact Reduction*, Beilstein Journal of Nanotechnology **3**, 637-650 (2012).
18. **Baykara, M.Z.**, Schwendemann, T.C., Altman, E.I., Schwarz, U.D., *Three-Dimensional Atomic Force Microscopy – Taking Surface Imaging to the Next Level*, Advanced Materials **22**, 2838-2853 (2010).
19. Albers, B.J., Schwendemann, T.C., **Baykara, M.Z.**, Pilet, N., Liebmann, M., Altman, E.I., Schwarz, U.D., *Three-Dimensional Imaging of Short-Range Chemical Forces with Picometre Resolution*, Nature Nanotechnology **4**, 307-310 (2009).
20. Albers, B.J., Schwendemann, T.C., **Baykara, M.Z.**, Pilet, N., Liebmann, M., Altman, E.I., Schwarz, U.D., *Data Acquisition and Analysis Procedures for High-Resolution Atomic Force Microscopy in Three Dimensions*, Nanotechnology **20**, 264002 (2009).
21. Vaz, C.A.F., Wang, H.Q., Ahn, C.H., Henrich, V.E., **Baykara, M.Z.**, Schwendemann, T.C., Pilet, N., Albers, B.J., Schwarz, U.D., Zhang, L.H., Zhu, Y., *Interface and Electronic Characterization of Thin Epitaxial Co<sub>3</sub>O<sub>4</sub> Films*, Surface Science **603**, 291-297 (2009).
22. Albers, B.J., Liebmann, M., Schwendemann, T.C., **Baykara, M.Z.**, Heyde, M., Salmeron, M., Altman, E.I., Schwarz, U.D., *Combined Low-Temperature Scanning Tunneling/Atomic Force Microscope for Atomic Resolution Imaging and Site-Specific Force Spectroscopy*, Review of Scientific Instruments **79**, 033704 (2008).

## EDITORIALS

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1. **Baykara, M.Z.** and Schwarz, U.D., *Noncontact Atomic Force Microscopy III*, Beilstein Journal of Nanotechnology **7**, 946-947 (2016).
2. **Baykara, M.Z.** and Schwarz, U.D., *Noncontact Atomic Force Microscopy II*, Beilstein Journal of Nanotechnology **5**, 289-290 (2014).
3. Glatzel, T., Hölscher, H., Schimmel, T., **Baykara, M.Z.**, Schwarz, U.D., Garcia, R., *Advanced Atomic Force Microscopy Techniques*, Beilstein Journal of Nanotechnology **3**, 893-894 (2012).

## INVITED BOOK CHAPTERS

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1. **Baykara, M.Z.**, Morgenstern, M., Schwarz, A., Schwarz, U.D., “Low-Temperature Scanning Probe Microscopy”, *Handbook of Nanotechnology*, 4<sup>th</sup> ed., Berlin: Springer (2017), in press.
2. **Baykara, M.Z.** and Schwarz, U.D., “Atomic Force Microscopy: Methods and Applications”, *Encyclopedia of Spectroscopy and Spectrometry*, 3<sup>rd</sup> ed., Oxford: Elsevier, 70-75 (2016).
3. **Baykara, M.Z.** and Schwarz, U.D., “3D Force Field Spectroscopy”, *Noncontact Atomic Force Microscopy*, vol. 3, Berlin: Springer, 9-28 (2015).
4. **Baykara, M.Z.**, “Noncontact Atomic Force Microscopy for Atomic-Scale Characterization of Material Surfaces”, *Surface Science Tools for Nanomaterials Characterization*, Berlin: Springer, 273-316 (2015).

## Ph.D. THESIS

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- **Baykara, M.Z.**, *Atomic-Resolution Quantification of Chemical Interactions Using Three-Dimensional Atomic Force Microscopy*, Yale University, New Haven, USA (2012).

## PATENT APPLICATIONS

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1. **Baykara, M.Z.**, *Material System with Sub-Micrometer-Scale Interfaces Exhibiting Structural Lubricity under Ambient Conditions and the Method for Synthesis Thereof*, United States Patent and Trademark Office (USPTO), 1495300.
2. **Baykara, M.Z.**, *Material System with Sub-Micrometer-Scale Interfaces Exhibiting Structural Lubricity under Ambient Conditions and the Method for Synthesis Thereof*, Republic of Turkey Patent Institute (TPE), 2015/07405.

## RESEARCH GRANTS

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### *Principle Investigator*

1. “Investigating Graphene Covered with Self Assembled Monolayer Structures via STM and Testing Its Use as a Chemical Sensor”, *3501 Program*, TÜBİTAK, 2015-2017.
2. “Developing an Atomic Force Microscope for Biological Research”, *1505 Program*, TÜBİTAK, 2015-2017.
3. “Investigating the Effect of Interface Structure on Friction at the Nanoscale”, *Career Integration Grant (CIG)*, Marie Curie Actions of the Seventh Framework Program, European Commission, 2013-2017.

### *Researcher*

4. “A Joint Theoretical and Experimental Study on the Nanotribological Properties of the Interface between Au and Two-Dimensional Systems”, *1001 Program*, TÜBİTAK, 2016-2019.  
(PI: Prof. Hande Toffoli, Physics Department, Middle East Technical University)

**INVITED TALKS, SEMINARS AND LECTURES (selected)**

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1. **Baykara, M.Z.**, *Fundamental Studies of Friction via Atomic Force Microscopy*, Max Planck Institute for Polymer Research, Mainz, Germany, June 22, 2017.
2. **Baykara, M.Z.**, *Revealing the Origins of Friction via Atomic Force Microscopy*, Kobe University, Department of Chemistry Seminar, Kobe, Japan, June 9, 2017.
3. **Baykara, M.Z.**, *Structural Lubricity under Ambient Conditions*, 2017 Spring Meeting of the Deutsche Physikalische Gesellschaft (DPG), Dresden, Germany, March 23, 2017.
4. **Baykara, M.Z.**, *A Crash Course on Atomic Force Microscopy: From Single Atom Chemistry to Structural Lubricity*, University of California, Merced, USA, January 23, 2017.
5. **Baykara, M.Z.**, *Nanotribology Experiments on Carbon-Based Materials*, 3<sup>rd</sup> Emerging 2D Materials & Graphene Conference, Istanbul, Turkey, October 21, 2016.
6. **Baykara, M.Z.**, *Three Decades of Atomic Force Microscopy: Implications for Physics, Chemistry and Biology*, ICTP-ECAR Workshop: Physical, Biological and Chemical Foundations of Bioelectronics, Biophotonics and Biosensors, Izmir, Turkey, July 29, 2016.
7. **Baykara, M.Z.**, *Real-Space, Atomic-Scale Measurement of Chemical Reactivity on Metal Oxide Surfaces via 3D-SPM*, EMN Spring Meeting 2016, Taipei, Taiwan, March 11, 2016.
8. **Baykara, M.Z.**, *Searching for Structural Lubricity under Ambient Conditions via Nanomanipulation Experiments*, 6<sup>th</sup> European Nanomanipulation Workshop, Giessen, Germany, September 23, 2015.
9. **Baykara, M.Z.**, *A Crash Course on Nanotribology: Atomic Force Microscopy, Nanoparticles, and Superlubricity*, Koç University, College of Engineering Seminar, Istanbul, Turkey, May 6, 2015.
10. **Baykara, M.Z.**, *Multichannel Scanning Probe Microscopy for the Investigation of Atomic-Scale Surface Chemistry*, Middle East Technical University, Chemistry Department Seminar, Ankara, Turkey, December 12, 2014.
11. **Baykara, M.Z.**, *From Single Atoms to Sliding Nanoparticles: Scanning Probe Microscopes Get to the Point*, Boston University, Mechanical Engineering Department Seminar, Boston, USA, November 14, 2014.
12. **Baykara, M.Z.**, *Force Microscopy Pushed to the Limit: Visualizing Atomic-Scale Interactions on Surfaces*, Boğaziçi University, Physics Department Seminar, Istanbul, Turkey, November 21, 2012.
13. **Baykara, M.Z.**, *Atomic-Scale Measurement of Surface Chemical Interactions*, Istanbul Technical University, Physics Department Seminar, Istanbul, Turkey, November 16, 2012.
14. **Baykara, M.Z.**, *Atomic-Resolution Quantification of Chemical Interaction Forces Using Three-Dimensional Atomic Force Microscopy*, Columbia University, Condensed Matter Physics Seminar, New York City, USA, February 3, 2012.
15. **Baykara, M.Z.**, *Materials Science on the Atomic Scale: Three-Dimensional Atomic Force Microscopy and its Applications*, Bilkent University, Mechanical Engineering Department Seminar, Ankara, Turkey, October 28, 2011.
16. **Baykara, M.Z.**, *Tuning Fork Based Low Temperature AFM/STM at Yale University and Three-Dimensional Force/Energy Field Imaging of Graphite*, 2nd EDIS2009 International Symposium on Electronic Devices Innovation, Osaka, Japan, January 15, 2010.

**CONFERENCE PRESENTATIONS (selected)**

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1. Özoğul, A., **Baykara, M.Z.**, *Investigation of Structural Lubricity on Platinum Nanoislands under Ambient Conditions*, 7<sup>th</sup> European Nanomanipulation Workshop, Jena, Germany, February 20-22, 2017.
2. Balkanci, A., Ye, Z., Martini, A., **Baykara, M.Z.**, *Nanotribology of Graphene Revisited: The Influence of Contact Size and Substrate Topography*, AVS 63<sup>rd</sup> International Symposium & Exhibition, Nashville, USA, November 6-11, 2016.
3. Cihan, E. and **Baykara, M.Z.**, *Superlubric Sliding of Gold Nanoparticles on Graphite under Ambient Conditions*, AVS 62<sup>nd</sup> International Symposium & Exhibition, San Jose, USA, October 18-23, 2015.
4. **Baykara, M.Z.**, Todorovic, M., Mönig, H., Schwendemann, T.C., Rodrigo, L., Uluutku, B., Altman, E.I., Perez, R., Schwarz, U.D., *Tip Apex Identification, Asymmetry, and Feedback-Induced Cross-Talk in Combined Atomic Force/Scanning Tunneling Microscopy Experiments*, 18<sup>th</sup> International Conference on NC-AFM, Cassis, France, September 7-11, 2015.
5. **Baykara, M.Z.**, *High-Resolution Multichannel Scanning Probe Microscopy: 3D Force Field Spectroscopy, Tip Apex Identification, and Cross-Talk*, HR-SPM 2015, Prague, Czech Republic, February 23-24, 2015.
6. **Baykara, M.Z.**, Ritter, C., Stegemann, B., Heyde, M., Rademann, K., Schroers, J., Schwarz, U. D., *Non-Uniform Friction-Area Dependency for Antimony Oxide Surfaces Sliding on Graphite*, AVS 60<sup>th</sup> International Symposium & Exhibition, Long Beach, USA, October 27 – November 1, 2013.
7. **Baykara, M.Z.**, Mönig, H., Todorovic, M., Schwendemann, T.C., Perez, R., Altman, E.I., Schwarz, U.D., *Atom-Specific Interaction Quantification and Identification by 3D-SPM*, 14<sup>th</sup> International Conference on NC-AFM, Lindau, Germany, September 18-22, 2011.
8. **Baykara, M.Z.** and Schwarz, U.D., *Atom-Specific Interaction Quantification and Identification for Catalytic Surfaces Using Three-Dimensional Atomic Force Microscopy*, 71<sup>st</sup> Physical Electronics Conference, Albany, USA, June 14-17, 2011.
9. **Baykara, M.Z.**, Schwendemann, T.C., Mönig, H., Todorovic, M., Perez, R., Altman, E.I., Schwarz, U.D., *Chemical Imaging and Interaction Quantification on the Surface Oxide Layer of Cu(100) Using High-Resolution Atomic Force Microscopy*, AVS 57<sup>th</sup> International Symposium & Exhibition, Albuquerque, USA, October 17-22, 2010.
10. **Baykara, M.Z.**, Mönig, H., Schwendemann, T.C., Altman, E.I., Schwarz, U.D., *Chemical Imaging and Interaction Quantification for Catalytic Materials Using High-Resolution Atomic Force Microscopy*, International Workshop on Scanning Probe Microscopy for Energy Applications, Oak Ridge National Labs, Oak Ridge, USA, September 14-17, 2010.
11. **Baykara, M.Z.**, Schwendemann, T.C., Albers, B.J., Pilet, N., Altman, E.I., Schwarz, U.D., *Why Is Graphite So Slippery? Gathering Clues from Atomically Resolved Three-Dimensional Lateral Force Measurements*, AVS 56<sup>th</sup> International Symposium & Exhibition, San Jose, USA, November 8-13, 2009.
12. **Baykara, M.Z.**, Schwendemann, T.C., Albers, B.J., Pilet, N., Altman, E.I., Schwarz, U.D., *Three-Dimensional Imaging and Quantification of Short-Range Chemical Forces with Picometer Resolution*, 69<sup>th</sup> Physical Electronics Conference, New Brunswick, USA, June 16-19, 2009.

## GRADUATE RESEARCH SUPERVISION

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- **Tarek Abdelwahab**, *Genetically-Tunable Morphology and Mechanical Properties of Bacterial Functional Amyloid Nanofibers*, Department of Mechanical Engineering, Bilkent University (2014 – 2017)
- **Arda Balkancı**, *Influence of Interface Structure on the Nanotribological Properties of Exfoliated Graphene*, Department of Mechanical Engineering, Bilkent University (2013 – 2016)
- **Ebru Cihan**, *Structure and Nanotribology of Thermally Deposited Gold Nanoparticles on Graphite*, Institute of Materials Science & Nanotechnology, Bilkent University (2013 – 2015)
- **Tuna Demirbaş**, *Nanotribological Properties of Graphene Grown by Chemical Vapor Deposition and Transferred onto Silicon Oxide Substrates*, Department of Mechanical Engineering, Bilkent University (2013 – 2015)
- **Alper Özoğul**, *Investigation of Structural Lubricity on Platinum Nanoparticles under Ambient Conditions*, Department of Mechanical Engineering, Bilkent University (2015 – 2017)
- **Berkin Uluutku**, *Modeling of NC-AFM Experiments by the Utilization of Molecular Dynamics and the Harmonic Oscillator Model*, Department of Mechanical Engineering, Bilkent University (2015 – 2017)

## EDITORIAL APPOINTMENT

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- **Guest Editor** at the *Beilstein Journal of Nanotechnology*

## JOURNAL REVIEWER APPOINTMENTS

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- *Applied Surface Science*
- *Beilstein Journal of Nanotechnology*
- *Friction*
- *Journal of Physical Chemistry C*
- *Journal of Vacuum Science & Technology B*
- *Measurement Science & Technology*
- *Nanotechnology* (selected as *Outstanding Reviewer* in 2016)
- *Review of Scientific Instruments*
- *Surface Science*
- *Tribology Letters*

## GRANT PROPOSAL REVIEWER APPOINTMENTS

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- **Grant Proposal Reviewer**, Netherlands Technology Foundation STW
- **Grant Proposal Reviewer and External Consultant**, TÜBİTAK

## MEMBERSHIP IN INTERNATIONAL SOCIETIES

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- *American Vacuum Society (AVS)*

**Candidate for Chair-Elect**, Nanometer-Scale Science and Technology Division (NSTD), 2016/17

**Executive Committee Member**, Nanometer-Scale Science and Technology Division (NSTD), 2014 – 2016

## CONFERENCE & WORKSHOP ORGANIZATION

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### Chair

- 2<sup>nd</sup> Graphene and Related Materials Conference (GRM-2016), Ankara, Turkey, July 13-15, 2016

### Organizer

- UNAM NanoColloquium Series, Bilkent University, Ankara, Turkey, 2016-2017
- UNAM NanoDay Symposia, Bilkent University, Ankara, Turkey, 2016-2017

### Member of the Scientific Committee

- 13<sup>th</sup> NanoTR Conference, Antalya, Turkey, October 22-25, 2017
- 7<sup>th</sup> European Nanomanipulation Workshop, Jena, Germany, February 20-22, 2017

### Member of the Local Organizing Committee

- 30<sup>th</sup> European Conference on Surface Science (ECOSS), Antalya, Turkey, August 31 – September 5, 2014

### Member of the Scientific Program Committee

- AVS 63<sup>rd</sup> International Symposium & Exhibition, Nashville, USA, November 6-11, 2016
- AVS 62<sup>nd</sup> International Symposium & Exhibition, San Jose, USA, October 22-26, 2015

## TEACHING EXPERIENCE

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### *Bilkent University*

- ME 101: Fundamentals of Mechanical Engineering
- ME 231: Mechanics and Materials I
- ME 232: Mechanics and Materials II
- ME 343: Mechanical Vibrations
- ME 446: Applications of Solid Mechanics
- ME 501: Mathematical Techniques in Mechanical Engineering
- ME 516: Tribology: Friction, Lubrication and Wear

### *Yale University*

- Resident Math and Science Tutor at Timothy Dwight College and the Quantitative Reasoning Center
- Teaching Fellow for MENG 285: Introduction to Materials Science
- Teaching Fellow for MENG 385: Materials Science of MEMS
- Teaching Fellow for MENG 383: Dynamics
- Teaching Fellow for MENG 280: Mechanics of Materials