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BARBAROS ÖZYILMAZ

EDUCATION

Graduate degree: Ph.D. in Physics, New York University (NYU), NY, USA. January 2005.
Ph.D. supervisor: Professor Andrew Kent
Undergraduate degree: Diplom-Physiker, RWTH Aachen University, Germany, Sept. 1999.

WORK HISTORY

July 2016 till present: Deputy Director (Translation)

Centre of Advanced 2D Materials, National University of Singapore (NUS), Singapore.

October 2014 till present: Head of Graphene Research

Centre of Advanced 2D Materials, National University of Singapore (NUS), Singapore.

September 2015 till present Professor

Department of Materials Science and Engineering

September 2013 till present: Professor

Department of Physics, National University of Singapore (NUS), Singapore.

December 2007 to September 2013: Assistant Professor

Physics Department, National University of Singapore (NUS), Singapore.

January 2005 to December 2007: Postdoctoral Research Fellow

Physics Department (with Prof. Philip Kim), Columbia University, New York, USA.

June 2004 to December 2004: Postdoctoral Research Fellow

II. Physikalische Institute (Prof. G. Guentherodt), RWTH AACHEN University, Germany.

November 1997 to April 1999: Research Assistant

European High Magnetic Field Lab (LCMI-CNRS, with Prof. Peter Wyder; RWTH AACHEN, with Prof. Laurens Molenkamp), Grenoble, France.

PROFESSIONAL ACCOMPLISHMENTS AND INNOVATIONS

- **Set up** first 260m^2 high magnetic field- low temperature transport laboratory at the National University of Singapore-NUS (2008).
- **Founding member** of the Graphene Research Center at NUS (2010)
- Set up jointly with Prof Konstantin Novoselov globally the first class 100/1000 clean room nanodevice fabrication facility (1000m^2) dedicated to 2D materials research at NUS.
- **Founding member** of the Center of Advanced 2D Material at NUS (August 2014).
- **Scientific publications:** Almost 100 publications in peer reviewed, international, top tier journals, with a total of more than 16,000 citations and an h-index of 39.
- **Patent applications:** 2 licensed patents, 1 patent jointly developed by industry, 8 awarded patents in 11 countries, 17 patents at PCT Stage.

- **Invited talks at scientific meetings:** More than 100 invited talks at international conferences to present research accomplishments.

- **Organizing committee of scientific meetings:** Co-organized a total of 16 international conferences (detailed list attached in Annex IV). Notable conferences co-organized:
  - MRS Spring Meeting, Symposium S: Graphene Materials and Devices (2010,2015),
  - American Physical Society, March Meeting, Focus Symp. Graphene Electronics (2009),
  - Asian Conference on Nanoscience and Nanotechnology (2008).
  - Graphene Week 2017 Athens, Greece,
  - Research Progress in Graphene Research (RPGR) (2009-2013,2015),
- **Significant competitive research funding secured for** the understanding of the fundamental properties of graphene and for developing graphene based applications:
  - Singapore NRF Competitive Research Programme (S$10,000,000):"Toward Commercialization of Graphene Technologies"
  - Singapore NRF Research Fellowship (S$2,750,000): "Phase Coherent charge and spin transport in nanostructured graphene and ferromagnet hybrid devices."
  - US Office of Naval Research NICOP (S$590,000):"Non-volatile graphene ferroelectric memory"
- **Reviewed research proposal for various national and international research foundations:**

  The Netherlands' Foundation for Fundamental Research on Matter (FOM); US National Science Foundation (NSF) on funding for Materials Research Science and Engineering Centre (MRSEC) proposals; Swiss National Science Foundation (SNSF), Div. Mathematics, Physical and Engineering Sciences; Scientific and Technological Research Council of Turkey (TUBITAK); U.S.-Israel Binational Science Foundation; Deutsche Forschungsgemeinschaft; European Science Foundation.
- **Reviewer for leading scientific journals:** Science, Nature, Nature Materials, Nature Physics, Nature Nanotechnology, Naure Communications Physical Review Letters (PRL), ACS NANO, Nanoletters, Advanced Materials, Angewandte Chemie, Journal of American Chemical Society (JACS), etc.
- **Joint development projects with Industry:**
  - Fuji Electric (Malaysia); Graphene based magnetic hard disc protective overcoats (August 2013 – May 2018);
  - Product and process development with leading component and manufacturing companies in energy storage and touch displays.

AWARDS, GRANTS AND ACKNOWLDEGMENT OF PROFESSIONAL CONTRIBUTIONS

Dean's Dissertation Fellowship, Graduate School of Arts and Science, New York University (NYU), NY USA.
Recognizes Excellence and promise in the work of advanced graduate students who are writing their Ph.D. dissertation. Award Includes stipend US$17,000, a waiver of matriculation fees, and full coverage of NYU comprehensive health insurance plan.

NRF FELLOWSHIP (inaugural) 2008, National Research Foundation, Singapore.
The Singapore NRF Fellowship Scheme is a globally competitive program to attract and root young scientists and researchers in Singapore. Grant amount S$3,000,000 over 5 years.

SMF–NUS Research Horizons Award – Phase I&II 2009 (inaugural), Singapore Millennium Foundation and the National University of Singapore, Singapore.
Award which fosters innovation in research; expands the pipeline of ideas that merit further exploration it looks for ideas which are substantially or totally novel, preferably cross-disciplinary, and (if fulfilled) would change current views substantially. Grant amount: S$850,000 over four years.

Young Investigator Award (YIA) 2010, National University of Singapore (NUS), Singapore.
Offers research funding to highly promising young faculty members; who are likely to make significant contributions to the development of research at NUS.

Grant amount: S$500,000 for three years.

Young Scientist Award 2012, Science Faculty, National University of Singapore (NUS), Singapore.
The Young Scientist Award (YSA) is conferred to researchers below 40 years of age based on the potential impact in their respective areas of research.

Young Research Award (YRA) 2013, National University of Singapore (NUS), Singapore.
The YRA is conferred to researchers below 40 years of age. The University Researcher Awards organised by the Division of Research Administration and the Office of the Deputy President (Research & Technology) are given out annually to recognize outstanding staff achievements and to stimulate quality research in the University.

IPS World Scientific Award 2013, Institute of Physics, Singapore.
For outstanding contribution to Graphene research in Singapore.

SELECTED PUBLICATIONS

1. **Gate-tunable black phosphorus spin valve with nanosecond spin lifetimes**; Avsar, A., Jun Y. Tan, Kurpas, M., Martin, G., Watanabe, K., Taniguchi T., Fabian, J., Özyilmaz B.; Nature Physics (2017, in press).
2. **Rashba Interaction and Local Magnetic Moments in a Graphene-BN Heterostructure Intercalated with Au**; O'Farrell, E. C. T., Tan, J. Y., Yeo, Y., Koon, G. K. W., Özyilmaz, B., Watanabe, K. and Taniguchi, T.; Phys. Rev. Lett. 117, 076603 (Aug 2016).
3. **Controlling many-body states by the electric field effect in a two-dimensional material**; Li, L. J., O'Farrell, E. C. T., Loh, K. P., Eda, G., Özyilmaz, B., and Castro Neto, A. H.; Nature 529, 185–189 (Jan 2016).
4. **Accessing the transport properties of pristine few-layer black phosphorus by van der Waals passivation in inert atmosphere**; Doganov, R. A., O'Farrell, E. C. T., Koenig, S. P., Yeo, Y., Ziletti, A., Carvalho, A., Campbell, D. K., Coker, D. F., Watanabe, K., Taniguchi, T., Castro Neto, A. H., and Özyilmaz, B.; Nat. Commun. (2015).
5. **Spin-Orbit Proximity Effect in Graphene**; Avsar, A., Tan, J. Y., Balakrishnan, J., Koon, G. K. W., Lahiri, J., Carvalho, A., Rodin, A. S., Taychatanapat, T., O'Farrell, E. C. T., Eda, G., Castro Neto, A. H., and Özyilmaz, B.; Nature Comms., 5:4875.
6. **Giant Spin Hall Effect in Graphene Grown by Chemical Vapor Deposition**; Balakrishnan, J., Koon, G. K. W., Avsar, A., Ho, Y., Lee, J. H., Jaiswal, M., Baeck, S-J., Ahn, J-H., Ferreira, A., Cazalilla, M. A., Castro Neto, A. H., and Özyilmaz, B.; Nature Comms., 5:4748.
7. **Length-dependent thermal conductivity in suspended single-layer graphene**; Xu, X., Pereira, L. F. C., Wang, Y., Wu, J., Zhang, K., Zhao, X., Bae, S., Tinh Bui, C., Xie, R., Thong, J. T. L., Hong, B. H., Loh, K. P., Donadio, D., Li, B., and Özyilmaz, B.; Nature Communications 5:3689.
8. **Electric field effect in ultrathin black phosphorus**; Koenig, S. P., Doganov, R. A., Schmidt, H., Castro Neto, A. H., and Özyilmaz, B.; Appl. Phys. Lett. 104, 103106
9. **Colossal Enhancement of Spin-Orbit Coupling in Weakly Hydrogenated Graphene**; Balakrishnan, J., Koon, G. K. W., Jaiswal, M., Castro Neto, A. H., Özyilmaz, B.; Nature Physics 9, 284–287.
10. **Graphene–Ferroelectric Hybrid Structure for Flexible Transparent Electrodes**; G.-X. Ni, Y. Zheng, S. Bae, C.Y. Tan, O. Kahya, J. Wu, B.H. Hong, K. Yao, B. Özyilmaz; ACS Nano, 6 (5), pp 3935–394.
11. **Graphene for Controlled and Accelerated Osteogenic Differentiation of Human Mesenchymal Stem Cells**; T. R. Nayak, H. Andersen, V. S. Makam, C. Khaw, S. Bae, X. Xu, P.-L. R. Ee, J.-H. Ahn, B. H. Hong, G. Pastorin & B. Özyilmaz; ACS Nano 5(6) 4670–4678.
12. **Roll-to-roll production of 30-inch graphene films for transparent electrodes**; S. Bae, H. Kim, Y. Lee, X. Xu, J.-S. Park, Y. Zheng, J. Balakrishnan, T. Lei, H. R. Kim, Y. I. Song, Y.-J. Kim, K. S. Kim, B. Ozyilmaz, J.-H. Ahn, B. H. Hong & S. Iijima.; Nature Nanotechnology 5, 574-578.

SELECTED INVITED TALKS

- Gordon Research Conference (June 2017); Novel Trends in Superconductivity of Correlated Electrons (New Haven, 2017),
- AIST Japanese Graphene industry Consortium meeting (Tokyo, 2015),
- Graphene LIVE (IdTechEx Conference and Tradeshow) (Berlin, 2014),
- Graphene Week (2012, 2013, 2015),
- Research Progress in Graphene Research (RPGR) (2009-2013,2015),
- International Conference on Electronic Properties of Two-Dimensional Systems/Conference on Modulated Semiconductor Structures (Japan, 2015)
- American Physical Society (APS) March Meeting (2013,2015,2017),
- Korean Parliamentary Session on Graphene's importance for Korean industry (2011),
- Material Research Society (MRS) Spring Meeting (2010).

LICENSED PATENTS

Licensee: Spin Transfer Technologies Inc., Fremont, California

Inventors: Oezyilmaz, B.; Kent, A. D.; del Barco, E.
Title: High speed low power magnetic devices based on current induced spin-momentum transfer. **Patent Details:** United States Pat. 6,980,469, 24/12/2005. United States Pat. 7,170,778, 30/01/2007. United States Pat. 7,573,737, 31/10/2007. PCT Pat. PCT/US2004/02689, 18/08/2004. Canada Pat. 2535965, 17/02/2006. European Pat. 2004781554, 20/03/2006. Japan Pat. 2006524031, 17/02/2006.

Inventors: Oezyilmaz, B.; Kent, A. D.
Title: Electronic Devices Based On Current Induced Magnetization Dynamics In Single Magnetic Layers. **Patent Details:** United States Pat. 7,986,544, 26/07/2011. European Pat. EP20070874397, 5/11/2007. PCT Pat. PCT/US07/83676, 5/11/2007.

Spin Transfer Technologies (STT) is a company established in 2011 by Allied Minds and New York University. The company has built a complete magnetics R&D fab at its Fremont, CA headquarters to accelerate MRAM technology development. STT has raised a total of $108 million from investors in multiple funding rounds.

SELECTED GRAPHENE PATENTS (AWARDED)

1. **Inventors:** Oezyilmaz, B.; Stier, A. V.; Castro Neto, A. H.; Martin Fernandez, I.; Ng, W. L.
   Title: Graphene As A Protective Overcoat For Magnetic Media Without the Use of Nucleation.Layer. **Patent Details:** PCT PCT/SG2015/000117 07/04/2015.; United States Pat. Pending 15/301,790 04/10/2016.; Malaysia Pat. Pending PI 2016703667 06/10/2016.; Japan Pat. Pending 2016-561769 07/10/2016

2. **Inventors:** Oezyilmaz, B.; Pastorin, G. **Title**: Method for Controlling and Accelerating Differentiation of Stem Cells Using Graphene Substrates. **Patent Details**: Singapore Pat. Granted 201209136-9 12/12/2012.; United States Pat. Pending 13/805,328 18/12/2012.; Canada Pat. Pending 2804647 07/01/2013

3. **Inventors:** Oezyilmaz, B.; Ni. G. X.; Zheng Y.
   Title: Transparent Graphene Conductor with Permanent Dipole Layer. **Patent Details:** Singapore Pat. Granted 201302912-9 17/04/2013.; China Pat. Granted 201180054385.4 10/05/2013.; Japan Pat. Pending 2013-538692 15/05/2013.; South Korea Pat. Pending 2013-7014524 05/06/2013

4. **Inventors:** Oezyilmaz, B.; Lee, J. H.; Kahya, O.
   Title: Synthesis Of Three-Dimensional Graphene Foam: Use As Supercapacitors. **Patent Details:** Singapore Pat. Granted 11201406702W 17/10/2014.; United States Pat. Granted 14/396,000

21/10/2014.; European Pat. Pending 13796748.5 17/12/2014.; PCT PCT/SG2013/000231 03/06/2013

5. **Inventors:** Oezyilmaz, B.; Toh, C. T.; Guang, X. N.; Zheng, Y.
Title: Graphene Memory Cell and Fabrication Methods Thereof. **Patent Details:** Singapore Pat. Granted 201102041-9 22/03/2011.; Japan Pat. Granted 2011-528984 23/03/2011.; South Korea Pat. Granted 10-2011-7008018 07/04/2011.; China Pat. Granted 200980140804.9 11/04/2011.; Germany Pat. Granted 09816537.6 01/05/2013.; Norway Pat. Granted 09816537.6 01/05/2013.; United Kingdom Pat. Granted 09816537.6 01/05/2013.; European Pat. Validated in EP 09816537.6 19/04/2011.; PCT PCT/SG2009/000352 23/09/2009

6. **Inventors:** Oezyilmaz, B.; Efetov, D.; Jarillo-Herrero, P.; Kim, P. **Title:** Locally gated graphene nanostructures and methods of making and using. **Patent Details:** United States Pat. Granted 8,659,009, 25/02/2014

7. **Inventors:** Oezyilmaz, B.; Toh, C. T.; Guang, X. N.; Zheng, Y.. **Title:** Non-Volatile Memory Devices Using Graphene and Ferro-Electric Thin Films. **Patent Details:** United States Pat. Granted 61/192,967 23/09/2008

MAIN RESEARCH THRUSTS

- **Engineering of spin orbit coupling in graphene via proximity effect, ad atom decoration and chemical functionalization**
- **Electric field tuning of many body states in 2D superconductors**
- **Room temperature spintronics applications of semiconducting 2D materials.**
- **Industrially saleable synthesis and process technologies of graphene films and graphene foams**
- **Functional coatings for magnetic hard disc drives**