

Çiçek Boztuğ, Ph.D.

Assistant Professor
TED University
Department of Electrical and Electronics Engineering
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PROFILE

Cicek Boztug received her Ph.D. degree from the Department of Electrical and Computer Engineering in Boston University. Her research focused on the development of mid-infrared group-IV laser, which will lead to monolithic integration of electronics and photonics on the same chip. During her M.S. and Ph.D. studies she developed a solid background on the semiconductor physics, thermoelectricity as well as the nanophotonics and nanoelectronics. More specifically, she is interested in the flexible optoelectronic devices, group-IV photonic-crystal lasers, development of lab-on-a-chip biosensors and development of group-IV lasers and photodetectors for optical communication.

EDUCATION

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| 2009-2014 | Ph.D. in Electrical and Computer Engineering
Boston University, Boston, MA, USA
<u>Advisor</u> : Prof. Roberto Paiella
<u>Thesis Title</u> : Tensilely Strained Germanium Nanomembranes for Infrared Light Emitting Devices
<u>CGPA</u> : 3.76 / 4.00 |
| 2007-2009 | M. S. in Electrical and Computer Engineering
University of Connecticut, Storrs, CT, USA
<u>Area of Study</u> : Physics and Applications of Thermoelectricity
<u>CGPA</u> : 3.94 / 4.00 |
| 2006-2007 (discontinued) | M. S. in Physics
Middle East Technical University, Ankara, Turkey |
| 2002-2006 | B. S. in Physics
Middle East Technical University, Ankara, TURKEY
<u>CGPA</u> : 3.53 / 4.00 (3 / 94 in ranking) |

EXPERIENCE

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| Fall 2014-present | Assistant Professor at Department of Electrical and Electronics Engineering, TED University, Ankara, Turkey |
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- Summer 2009-January 2014** Research Assistant at Electrical and Computer Engineering, Boston University, Boston, MA, USA
- Design of the AlN/GaN quantum wells for the demonstration of mid-infrared light emission from these structures
 - Demonstration of mid-infrared absorption in AlN/GaN quantum wells due to intersubband transitions in conduction band
 - Demonstration of strong photoluminescence from single-crystalline tensilely-strained germanium nanomembranes
 - First demonstration of the direct-bandgap single-crystalline germanium
 - Demonstration of 1) population inversion in single-crystalline tensilely-strained germanium nanomembranes and 2) the cavity resonances due to the 2D photonic crystals fabricated on top of Ge NMs opening the path towards the demonstration of on-chip germanium laser
- Spring 2009** Teaching Assistant at Electrical and Computer Engineering, Boston University, Boston, MA, USA
- Electric Circuits Laboratory
- 2007-2009** Research Assistant at Electrical and Computer Engineering, University of Connecticut, Storrs, CT, USA
- Research on the theoretical analysis of thermoelectric effects in silicon (Si) microwires
 - Fabrication of Si microwires at the cleanroom facilities of Cornell University
 - Demonstration of strong Thompson effect in Si microwires leading to asymmetric melting of the wires
 - Demonstration of the formation of single crystalline Si by the application of electrical pulses on amorphous Si microwires
- 2006-2007** Research and Teaching Assistant at the Department of Physics, Middle East Technical University, Ankara, Turkey
- General Physics I : Freshman Mechanics Laboratory
 - General Physics II : Freshman Electricity and Magnetism Laboratory

ACADEMIC SKILLS

- **Clean Room and Fabrication Skills**

Wafer cleaning, photolithography, electron-beam lithography, magnetron sputtering, electron beam deposition, reactive ion etching

- **Material Characterization Skills**

Scanning electron microscopy, atomic force microscopy, spectroscopic ellipsometry, Fourier transform infrared spectroscopy, current-voltage measurements, electroluminescence, photoluminescence

- **Computer Skills**

Comsol, Mathematica, Matlab, Rsoft / BeamProp, Lumerical, LabVIEW with GPIB and Instrumentation, Origin Pro, PeakFit, Rhinoceros, Layout Editor, C/C++ Programming, MS Office

AWARDS and FELLOWSHIPS

<i>Spring 2011</i>	Photonics Center Berman Future of Light Award at Boston University
<i>Spring 2009</i>	Graduate Student Teaching Fellowship at Boston University
<i>Summer 2008</i>	Graduate Student Mentor Fellowship for 2007 Northwest Alliance Summer Research Program for Minority Students at University of Connecticut
<i>2006-2007</i>	Graduate Student Fellowship from The Scientific and Technological Research Council of Turkey (TUBITAK)
<i>Spring 2003-Spring 2006</i>	Dean's Honor/High Honor List at Middle East Technical University

RESEARCH PROJECTS

- Design of a mid-infrared photonic crystal laser based on tensilely-strained germanium nanomembrane, The Scientific and Technological Research Council of Turkey (TUBITAK) 2232, **Principal Investigator**, December 2014

PUBLICATIONS

Peer-Reviewed Articles:

- **C. Boztug**, J. R. Sanchez-Perez, M. G. Lagally, R. Paiella, "Strained-germanium nanomembranes for infrared photonics", ACS Nano 8, 3136 (2014) (*Invited Review Article*)
- **C. Boztug**, J. R. Sanchez-Perez, J. Yin, M. G. Lagally, R. Paiella, "Grating-coupled mid-infrared light emission from tensilely strained germanium nanomembranes", Appl. Phys. Lett. 103, 201114 (2013)
- **C. Boztug**, J. R. Sanchez-Perez, F. F. Sudradjat, RB Jacobson, D. M. Paskiewicz, M. G. Lagally, R. Paiella, "Tensilely strained germanium nanomembranes as infrared optical gain media", Small 9, 622 (2013)
- J. R. Sanchez-Perez*, **C. Boztug***, F. Chen, F. F. Sudradjat, D. M. Paskiewicz, RB Jacobson, M. G. Lagally, R. Paiella, "Direct-bandgap light-emitting germanium in tensilely strained nanomembranes", Proc. Natl. Acad. Sci. USA 108, 18893 (2011) (*: Equal contribution)
- A. Cywar, G. Bakan, **C. Boztug**, H. Silva and A. Gokirmak, "Phase change oscillations in silicon microwires", Appl. Phys. Lett. 94, 072111 (2009)

Conference Proceedings:

- R. Paiella, **C. Boztug**, J. Sanchez-Perez, J. Yin, M. G. Lagally, “Tensilely strained germanium nanomembranes for direct-bandgap infrared light emission”, Proceedings of SPIE, 9162, 91621I (2014) (*Invited Paper*)
- **C. Boztug**, J. R. Sanchez-Perez, J. Yin, M. G. Lagally, R. Paiella, “Mechanically flexible photonic-crystal cavities on strained-germanium nanomembranes”, Conference on Lasers and Electro-Optics (CLEO): 2014, STu2H.4 (2014)
- **C. Boztug**, J. R. Sanchez-Perez, J. Yin, F. F. Sudradjat, D. M. Paskiewicz, RB Jacobson, M. G. Lagally, R. Paiella, “Grating-coupled strain-enhanced light emission from mechanically stressed germanium nanomembranes”, Conference on Lasers and Electro-Optics (CLEO): 2013, CF1I.8 (2013)
- **C. Boztug**, F. Chen, J. R. Sanchez-Perez, F. F. Sudradjat, D. M. Paskiewicz, RB Jacobson, M. G. Lagally, R. Paiella, “Direct-bandgap germanium active layers pumped above transparency based on tensilely strained nanomembranes”, Conference on Lasers and Electro-Optics (CLEO): 2011, PDPA2 (2011) (*Post-deadline Paper*)
- G. Bakan, A. Cywar, **C. Boztug**, M. Akbulut, H. Silva and A. Gokirmak, “Annealing of nanocrystalline silicon micro-bridges with electrical stress,” Mater. Res. Soc. Symp. Proc. 1144, LL03-25 (2009)
- **C. Boztug**, G. Bakan, M. Akbulut, N. Henry, A. Gokirmak and H. Silva, “Numerical modeling of electrothermal effects in silicon nanowires,” Mater. Res. Soc. Symp. Proc. 1083, R04-11 (2008)

CONFERENCE PRESENTATIONS

- R. Paiella, **C. Boztug**, J. Sanchez-Perez, J. Yin, M. G. Lagally, “Tensilely strained germanium nanomembranes for direct-bandgap infrared light emission”, Active Photonic Materials VI (*Invited Talk*)
- **C. Boztug**, J. R. Sanchez-Perez, J. Yin, M. G. Lagally, R. Paiella, “Mechanically flexible photonic-crystal cavities on strained-germanium nanomembranes”, Conference on Lasers and Electro-Optics (CLEO) 2013
- **C. Boztug**, J. R. Sanchez-Perez, J. Yin, F. F. Sudradjat, D. M. Paskiewicz, RB Jacobson, M. G. Lagally, R. Paiella, “Grating-coupled strain-enhanced light emission from mechanically stressed germanium nanomembranes”, Conference on Lasers and Electro-Optics (CLEO) 2013
- J. R. Sanchez-Perez, **C. Boztug**, F. Chen, F. F. Sudradjat, D. M. Paskiewicz, RB Jacobson, R. Paiella, M. G. Lagally, “Direct-bandgap infrared light emission from tensilely strained germanium nanomembranes” American Physical Society (APS) Meeting 2012
- **C. Boztug**, F. Chen, J. R. Sanchez-Perez, F. F. Sudradjat, D. M. Paskiewicz, RB Jacobson, M. G. Lagally, R. Paiella, “Direct-bandgap germanium active layers pumped above transparency based on tensilely strained nanomembranes”, Conference on Lasers and Electro-Optics (CLEO) 2011 (*Post-deadline presentation*)

- A. Cywar, G. Bakan, **C. Boztug**, H. Silva and A. Gokirmak, “Phase-change Oscillations in Silicon Micro-wires,” Material Research Society (MRS) Spring Meeting 2009.
- A. Gokirmak, G. Bakan, **C. Boztug**, A. Cywar and H. Silva, “Observation of Strong Phonon-drag Effect in Pulse Voltage Stressed Silicon Micro-bridges,” MRS Spring Meeting 2009.
- A. Gokirmak, G. Bakan, **C. Boztug**, A. Cywar, N. Henry, M. Akbulut and H. Silva, “Pulsed Current Annealing of Lithographically Defined Si Wires on Insulating Substrates for Single Crystal Si Ribbon Formation for 3D Integration,” MRS Fall Meeting 2008.
- A. Cywar, G. Bakan, **C. Boztug**, M. Akbulut, N. Henry, H. Silva and A. Gokirmak, “Pulsed Electrical Stressing of Amorphous/Nano-Crystalline Silicon Wires,” MRS Fall Meeting 2008.
- **C. Boztug**, G. Bakan, M. Akbulut, N. Henry, A. Gokirmak and H. Silva, “Numerical modeling of electrothermal effects in silicon nanowires,” MRS Spring Meeting 2008.
- G. Bakan, M. Akbulut, **C. Boztug**, N. Henry, H. Silva and A. Gokirmak, “Crystallization of Nanocrystalline Si Wires Through Self-heating,” MRS Spring Meeting 2008.