

## Curriculum vitae

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Engin Karabudak, Ph.D.,  
MESA+ Institute of Nanotechnology  
Faculty of Science and Technology  
Mesoscale Chemical Systems  
University of Twente  
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### Current employment

Since July 2011, I have been working on my research line in the direction of artificial photosynthesis on a microfluidic chip with a “Biosolar Cells” Grant (Title: *Photocatalytic Water Splitting in Microfluidic Devices*) from FOM (Foundation for Fundamental Research on Matter). Initial grant idea about artificial photosynthesis is invented, developed by myself. I have contacted various groups (Prof. Gardeniers from University of Twente (Mesoscale Chemical Systems group, UT), Prof. Joost Reek (Supramolecular Catalysis group, University of Amsterdam) and Prof. Fred Brouwer (Molecular Photonics group, University of Amsterdam) to initiate a network for this grant application. With efficient collaboration with the network members, we have further developed the idea to its final form and we have written the final grant (I have written the full Twente University part). Grant (Title: *Photocatalytic Water Splitting in Microfluidic Devices*) achieved a funding of **1.000.000 €** total) and 1/3 of the funding was received by the University of Twente.

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### Brief summary of past research:

The past research have been dedicated to the development of novel spectroscopy techniques and utilizing them for the purposes of better analyses of chemicals in extraordinary conditions or quantities.

Firstly, a novel X-ray photoelectron spectroscopy that is called is called “pulsed voltage XPS” is developed.

Secondly, In particular so-called MW-AUC ( a novel UV/Vis spectroscopy technique) has been evaluated for separating a semiconductor solution by size in atomic resolution and taking UV/Vis spectra of individual fractions. With the help of this method, quantum size effect for CdTe semiconductors has been studied. During the transfer of this technology to BASF, carbon nanotube and ligand interactions were also analyzed utilizing MW-AUC.

Thirdly, after changing the research topic to microfluidics, the problem of scarcity of the online chemical detection techniques that can work with micro- and nano volumes has been encountered. Another problem was that the techniques had not been designed for specific needs of microfluidic research. The so-called novel Attenuated Total Reflectance Infrared Spectroscopy (ATR-IR) has been developed and infrared spectra of liquids inside lithographically defined nanochannels of nano/microfluidic chips has been recorded. The smallest volume infrared study in the literature has been achieved and the first nanofluidic photoreactor with simultaneous IR analysis has been developed.

While performing research on microfluidics, a microfluidic approach to photosynthesis has been developed. Utilizing the ‘microfluidic photosynthetic leaf’ recent result about water oxidation inside a microfluidic chip has been achieved. Research on fabricating an artificial leaf is in progress.

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## Background:

**Postdoc in Artificial Photosynthesis/:** in the Mesoscale Chemical Systems group, with a “*Biosolar Cells*” Grant (Title: *Photocatalytic Water Splitting in Microfluidic Devices*), University of Twente. Since July 2011. (See current employment)

**Postdoc in Photocatalytics:** in PCS group, University of Twente, Subject: Evaluation of nano-fluidic devices for photochemistry, *November 2010 – July 2011*.

**Postdoc in Attenuated Total Reflectance Spectroscopy:** in the Mesoscale Chemical Systems group, University of Twente. Subject: Developing ATR-IR coupled micro-nanofluidic reactors, *July 2009 – October 2010*.

**Technology transfer to BASF AG:** *performed transfer of technology to BASF SE global competence center, May-June 2009***certificate for technology transfer to BASF SE global competence; Technology transfer to BASF AG:** performed the transfer of technology to BASF SE global competence center, Ludwigshafen, Germany; I have developed MW-AUC technique which can use thousands of wavelength at a time and cost only 60.000 € (Commercial Beckman Detection systems costs 500.000€ and which can only be used 3 wavelengths at a time)

**Ph.D. in Physical Chemistry:** Max Planck Institute of Colloids and Interfaces, Potsdam, Germany, 14/12/2009, Supervised by Prof. Dr. Marcus Antonietti and Dr. habil Helmut Coelfen. Title of thesis: “Development of MWL-AUC/CCD-AUC/SLS-AUC Detectors for Analytical Ultracentrifuge: *Study of proteins/nanoparticles/quantum dots/CNTs in solution phase and their interactions*”

**M.Sc. in Material Science:** Sabanci University, Istanbul, Turkey, 15/09/2006, Supervised by Assoc. Prof. I.I. Kaya. Thesis Title: “*Investigation of negative resistance induced by directional scattering in a two dimensional electron gas*”

**B.Sc. in Chemistry:** Bilkent University, 15/01/2004, Ankara, Turkey. Supervised by Assoc. Prof. Gershon Borovsky, Thesis Title: “*A new type of Direct Methanol Cell*”

**Fellowship in Material Science:** California Institute of Technology (CALTECH), USA, Summer Undergraduate Research Fellowship (SURF), (*First and only chemistry student from Turkey to be awarded with SURF*) Summer Research on “Superprotonic phase transition in CsH(PO<sub>3</sub>H), RbH(PO<sub>3</sub>H) and Cs<sub>x</sub>Rb(1-x) H(PO<sub>3</sub>H) crystals to be used as fuel cell electrolyte” Supervisor: Prof. Dr. Sossina M. Haile July 2003 - September 2003.

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## Scholarships, grants and prizes:

October 2010: “Towards Bisolar Cells” Grant (983.000 €) Grant idea about artificial photosynthesis is invented, developed by myself. I have initiated a network for the grant (Prof. Gardeniers from University of Twente, Prof. Joost Reek and Prof. Brouwer from University of Amsterdam). I wrote the Twente University part of the grant. 1/3 of the money will be received by the University of Twente.

June 2009: certificate for technology transfer to BASF SE global competence center

October 2006 – April 2009: Full Scholarship for PhD from Max Planck Society, Germany

2006-2004: Full scholarship in Master of Material Sciences, Sabanci University, Istanbul, Turkey

July 2003 -September 2003: Summer Undergraduate Research Fellowship (SURF), , California Institute of Technology (CALTECH), Pasadena, Los Angeles, USA

July 2002-September 2002: Max Planck Institute Foreign Researcher Scholarship, Germany

2002: Motorola Flash Microcontroller Design Contest Participant**Motorola** Flash Microcontroller Design Contest: Selected as representative of Department of Electrical and Electronics and Engineering, Bilkent University, Turkey. Full Development of new instrument called “Automatic Photometric Titration Machine” and presenting it in Motorola Design Contest in Ciragan Palace, 31st March 2002, Istanbul, Turkey., Istanbul, Turkey

1998-2004: Full Scholarship from Bilkent University Chemistry Department (Top Chemistry Department in Turkey; accepting *only 15 students* that are qualified with top marks in National University Exam)

1998: National University Exam (Turkey wide): Became 1470th over 1,000,000 students; which corresponds to 0.1 % of all students in Turkey

1997: Kocaeli University Mathematic Olympics: Second Degree, Kocaeli, Turkey

1995: National High School Exam (Turkey wide) qualified for entering “Golcuk Anatolian High School”, (educated in English), Golcuk, Turkey

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#### **Publications: International (refereed) journals**

##### ***Publications at Bilkent University Chemistry Department, Ankara, Turkey:***

1) (Impact Factor: **1.849**) (Cited **5** times) “XPS analysis with pulsed voltage stimuli”, Karabudak E, Demirok UK, Suzer S., Surface Science, Volume: 600, Issue: 2, Pages L12-L14, Jan 2006

##### ***Publications at Max Planck Institute of Colloids, Potsdam, Germany:***

2) (Impact Factor: **2.443**) (Cited **9** times) “Performance of a fast fiber based UV/Vis multiwavelength detector for analytical Ultracentrifugation”, Strauss HM., Karabudak E., Bhattacharyya S., Kretzschmar A., Wohlleben W., Coelfen H. , Colloid and Polymer Science, Volume 286, Issue 2, Pages 121-128, Feb 2008.

3) (Impact Factor: **2.387**) (Cited **3** times) “Investigation of  $\beta$ -carotene–gelatin composite particles with a multiwavelength UV/vis detector for the analytical ultracentrifuge”, Engin Karabudak, Wendel Wohlleben and Helmut Coelfen; European Biophysics Journal, Feb 2010, Volume:39, Issue:3, Pages: 397-403

4) (Impact Factor: **2.387**) (Cited **4** times) “The Open AUC Project” Helmut Coelfen, Thomas Laue, Wendel Wohlleben, Kristian Schilling, Engin Karabudak, Bradley Langhorst, Emre Brookes, Bruce Dubbs, Dan Zollars, Mattia Rocco, Borries Demeler; European Biophysics journal : Feb 2010, Volume:39, Issue:3, Pages: 347-59

##### ***Publications at BASF SE Global Competence Center, Ludwigshafen, Germany:***

5) (Impact Factor: **5.476**) (Cited **7** times) “Determination of the Surfactant Density on SWCNTs by Analytical Ultracentrifugation”, Claudia Backes, Engin Karabudak, Cordula D. Schmidt, Frank Hauke, Andreas Hirsch and Wendel Wohlleben, Chemistry – A European Journal, Volume 16, Issue 44, pages 13176 – 13184, November 22, 2010

6) (Impact Factor: **3.339**) (Cited **2** times) “A Universal Ultracentrifuge Spectrometer Visualizes CNT-Intercalant-Surfactant Complexes”, Engin Karabudak, Claudia Backes, Frank Hauke, Cordula D. Schmidt,

Helmut Cölfen, Andreas Hirsch and Wendel Wohlleben, ChemPhysChem, Volume 11, Issue 15, Pages 3224-3227, October 25, 2010

7) "Exchanging surfactants during band sedimentation to fractionate carbon nanotubes by diameter", Engin Karabudak, Claudia Backes, Frank Hauke, Cordula D. Schmidt, Nicolas, Berhard, Johnathan N. Coleman, Wendel Wohlleben, Andreas Hirsch (submitted to ACS Nano)

***Publications at MESA+ Institute of Nanotechnology, Enschede, The Netherlands:***

8) (Impact Factor: **5.874**) "ATR-IR Nanofluidic Chip: On-line Spectroscopic analysis of Knoevenagel Condensation and intermediates in 71 nL", Engin Karabudak, Barbara L. Mojet, Stefan Schlautmann, Guido Mul, Han Gardeniers (accepted to Analytical Chemistry 2012)

9) "A Nano-sized Photoreactor: the ideal platform for homogeneous light exposure and molecular composition", Engin Karabudak, Stefan Schlautmann, Guido Mul, Han (J.G.E.) Gardeniers, (submitted to Lab on a chip)

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**Important Workshops and Schools attended:**

NIOK Course: Characterization in Catalysis Research, Eindhoven University, 24-26 January 2011

NIOK, Catalysis, An Integrated Approach, Schiermonnikoog, 21-26 November 2010

Artificial Leaf Workshop, Lorentz Center, Leiden University, 1-5 February 2010

Fundamentals of Nanotechnology Workshop, MESA+ Institute of Nanotechnology, University of Twente, January 2010

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**Teaching Experience:**

2004- 2006: Teaching assistantship at Sabanci University, Istanbul, Turkey. Lecturing/ problem solving/

General Chemistry (2 semesters, 3 hours a week)

Differential Equations (1 semester, 3 hours a week)

Material Science (1 semester, 3 hours a week)

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**Scientific Visits:**

09-13 January 2012: Catalysis for Sustainable Energy Center, Denmark Technical University, invited by Prof. Soren Dahl (head of CASE).

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**Invited Talks:**

- 1) Oral Presentation at CASE (Catalysis for Sustainable Energy) center at Denmark Technical University, Title: "ATR-IR integrated micro-nano fluidic chips: Mechanistic study with nanoliters and first nanofluidic photoreactor", 09.January.2012

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**Conferences/Workshops/Presentations:**

- 2) Energy and Materials from The Sun, June 20-23, 2011, Rolduc Abbey, The Netherlands (Poster presentation).
- 3) Netherlands Catalysis and Chemistry Conference, NCCC, XII, 2011 (Poster Presentation)

- 4) NIOK Course: Characterization in Catalysis Research, Eindhoven University, 24-26 January 2011
  - 5) NIOK, Catalysis, An Integrated Approach, Schiermonnikoog, 21-26 November 2010
  - 6) Artificial Leaf Workshop, Lorentz Center, Leiden University, 1-5 February 2010
  - 7) Fundamentals of Nanotechnology Workshop, MESA+ Institute of Nanotechnology, University of Twente, January 2010
  - 8) Fundamentals of Nanotechnology Workshop, 2-6 November 2009, Enschede, The Netherlands
  - 9) 125th The Svedberg Anniversary; 18th International AUC Conference 13-18 September.2009, Uppsala University, Sweden; “New Generation of Multiwavelength Analytical Ultracentrifugation” (*Invited by Conference committee, Oral presentation*)
  - 10) Analytical Ultracentrifuge 2008 Conference, New Castle, UK (*Oral Presentation*)
  - 11) Analytical Ultracentrifuge 2007 Conference, Hannover, Germany (*Poster presentation*)
  - 12) American Physical Society March 2008 meeting, New Orleans, Louisiana, USA; Oral Presentation by Dr. Ismet I. Kaya (Abstract can be found at: [http://absimage.aps.org/image/MWS\\_MAR08-2007-006905.pdf](http://absimage.aps.org/image/MWS_MAR08-2007-006905.pdf))
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**Skills:**

***Instrumental Experience:***

3 years hands on clean room experience (2 years during the master studies in Turkey, 1 year in MESA+ in Netherlands), experienced in lithography techniques including ebeam lithography, microwire bonding, anodic bonding, sputtering, coating etc...

Well trained in Attenuated Total Reflectance- infrared (ATR-IR), Cryogenic Cryostat down to 1,2 K Kelvin, X-ray photoelectron spectroscopy (XPS), UV-Vis Spectroscopy, Infrared Spectroscopy , Raman Spectroscopy, Impedance Spectroscopy, Powder and single crystal X-ray diffraction (XRD), Thermal Gravimetric Analysis (TGA), Differential Scanning Calorimetry (DSC), Ultracentrifugation, Analytical Ultracentrifugation, Cyclic Voltammetry, Nuclear Magnetic Resonance (NMR), Scanning Electron microscopy.

***Programming:***

Assembly Language: Excellent, Labview: Excellent, Java: Good

***Mechanical Design:***

Capable of using Autocad, Solid Works programs

***Electronical Design:***

Capable of digital and microprocessor design (see certificate from Motorola)

***Optical Design:***

Expert on Ocean optic portable spectrometers and accessories and able to program them efficiently.

***Language:***

English (Fluent), Turkish (Native), Dutch (Finished Follow up 1 level), German (Basic)

***Hobbies:***

Offshore sailing, robotics, microelectronics, history, travelling

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Ludwigshafen  
July 1, 2009**C E R T I F I C A T E**

Mr. Engin K a r a b u d a k , born on November 27, 1980 in Balikesir/Türkei, took part in an internship in our Department of Polymer Physics from May 1, 2009 to June 30, 2009

During the internship, he was responsible for the following:

- **Goal was to finalize operating software for an analytical ultracentrifuge with novel Multi-Wavelength-Optics.**
- **This machine was developed in collaboration between MPI Golm and BASF SE from 2002 until 2009.**
- **The breakthrough was achieved by Mr. Karabudak during his PhD thesis, resulting in a transfer of the technology to BASF SE global competence center.**
- **During the internship, the operating software needed to be much enhanced in terms of reliability and user-friendliness.**
- **The last weeks of the internship were dedicated to experiments with inhomogeneous colloids.**

Mr. Karabudak always demonstrated an unusually high degree of initiative, strong dedication and the desire to perform well. His outstanding intellectual grasp, excellent analytical skills and judgment stood him in good stead even in demanding situations. Thanks to his excellent specialist knowledge, he acquired very good practical know-how within a short space of time. Mr. Karabudak made excellent use of the options on offer for his training. His work was of a consistently outstanding quality. He was an extremely conscientious intern, capable of working without supervision, who always approached the tasks he was given systematically. He always performed the tasks assigned him to our utmost satisfaction.

Mr. Karabudak proved to be a responsible intern, who always enjoyed a good relationship with superiors and colleagues alike thanks to his objective, helpful manner. He was a highly stimulating person, capable of justifying his own opinions convincingly, but likewise prepared to accept the given conditions and options, and derive the best from them by using his own initiative. His behavior and manner towards superiors and colleagues were exemplary.

We would like to thank Mr. Karabudak for his consistently good work and wish him all the best and much success for his future career.

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IBAN DE26 5454 0033 0201 0007 00  
SWIFT COBADEFF545Deutsche Bank Aktiengesellschaft  
Account No.: 0013302500, Sort code 545 700 94  
IBAN DE72 5457 0094 0013 3025 00  
SWIFT DEUTDESM545Chairman of the Supervisory Board:  
Eggert VoscherauBoard of Executive Directors:  
Juergen Hambrecht, Chairman;  
Kurt Bock, Martin Brudermueller,  
Hans-Ulrich Engel, John Feldmann,  
Andreas Kreimeyer, Stefan Marciniowski,  
Harald Schwager

# CALIFORNIA INSTITUTE OF TECHNOLOGY



DEPARTMENT OF MATERIALS SCIENCE

16 September 2003

Prof. Sefik Suzer  
Bilkent University  
Chemistry Department  
06800 Bilkent, Ankara  
Turkey

Dear Prof. Suzer:

It is my pleasure to inform you that Engin Karabudak spent ten weeks in my laboratory at the California Institute of Technology this summer, carrying out research on proton conducting compounds. In particular, he examined the solid solution system between  $\text{CsH}(\text{PO}_3\text{H})$  and  $\text{RbH}(\text{PO}_3\text{H})$  and established the rubidium content at which the transition to a phase of high conductivity is lost. His experiments spanned from chemical synthesis to characterization by X-ray diffraction, thermal analysis and impedance spectroscopy. Engin demonstrated that, while Cs rich compositions retained the so-called superprotonic transition, those with more than ~ 30% Rb simply melted upon heating; the results will form the basis of a journal publication. Overall, I was quite impressed with Engin's understanding of the problem and his skill in carrying out experimental research.

Sincerely,

A handwritten signature in cursive script, appearing to read "Sossina M. Haile".

Sossina M. Haile  
Assoc. Prof. of Materials Science and of Chemical Engineering



# CALIFORNIA INSTITUTE OF TECHNOLOGY

## STUDENT-FACULTY PROGRAMS SURF • MURF • Beckman Scholars • Axline SURF

April 3, 2003

Mr. Engin Karabudak  
Akdeniz Cad. 36/15  
Bahcelievler  
Ankara  
TURKEY

Dear Engin:

We are extremely pleased to award you a 2003 SURF fellowship under the mentorship of Dr. Sossina M. Haile. We considered your proposed research to be very attractive and believe that, collaborating with your mentor, you should have a rich research experience. This year the SURF fellowship is \$5000. Federal and state taxes may be withheld from your fellowship distributions depending on your tax status. We recommend you check with a tax advisor when you file your 2003 state and federal income taxes. The SURF period is June 16 through August 22.

The following forms are enclosed: The 2003 Acceptance Form, Student Information Sheet, summer housing in. Please inform the Student-Faculty Programs Office as soon as possible, but no later than April 15, if you do not plan to accept your award.

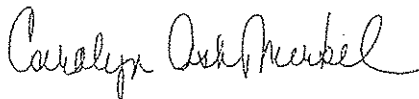
We call your attention to the requirements of the program outlined on the Acceptance Form. Each SURFer is responsible for completing all the requirements.

This year's program begins on Monday, June 16, 2003, with important orientation activities beginning at 2:00 pm. *Note: As we get closer to Orientation Day, please check your e-mail regularly for updates on specific times and locations of the various orientation activities.* You will receive all materials and schedules for the summer at these meetings. The meetings are followed by a barbecue in the Glanville Courtyard of the Beckman Institute.


The SURF program includes a variety of activities and we encourage you to participate in as many as interest you and for which you have time.

Congratulations! We wish you an enjoyable and productive summer.

Yours truly,



Carolyn Ash Merkel  
Director, SURF Program



Fredrick H. Shair  
Chairman, SURF Administrative Committee

cc: Dr. Sossina M. Haile  
Ms. Lisa A. Cowan

Mail Code 139-74, Pasadena, California 91125  
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E-mail: [sfp@its.caltech.edu](mailto:sfp@its.caltech.edu)  
URL: <http://www.its.caltech.edu/~sfp/>



Prof. Dr. rer. nat. Dr. h. c. Markus Antonietti  
Dr. habil. Helmut Cölfen

## MAX-PLANCK-INSTITUT FÜR KOLLOID- UND GRENZFLÄCHENFORSCHUNG

Max-Planck-Institut für Kolloid- und Grenzflächenforschung Golm, D-14424 Potsdam

Am Mühlenberg 1  
D-14476 Golm, Germany

Telefon: (0331)567-9501  
Telefax: (0331)567-9502

18. September 2002

### Reference on behalf of Mr. Engin Karabudak

Mr. Engin Karabudak worked in our institute in August and September 2002 as a summer project student in the framework of AUC 2004, which is a joint project between our Max-Planck-Institute and the BASF AG, Ludwigshafen concerning the development of new detectors for Analytical Ultracentrifuges. This project includes the optical, mechanical, electric and computational development of complete detector systems for Analytical Ultracentrifuges ranging from detector engineering to data acquisition aspects.

Mr. Karabudak had the task to design a flexible electronic multiplexer system which controls the timing and pulse lengths of either the flashed light sources or detectors with respect to a trigger pulse coming from the spinning rotor with up to eight sample positions. Although such systems have been designed before already in the mid 80's as electronic hardware with limited flexibility (this development took about three months work of an electronic engineer at these times), it was highly desired to adapt the needed electronic functions to a programmable PC basis with the sake of higher flexibility to changing experimental demands in the future. Already before the start of his project, Mr. Karabudak came up with a principal approach to design the multiplexer as a PC card programmed in assembler language. This solution probably would already have fulfilled the task of his project but during the intensive discussions with him at the start of his project, many more potential possibilities of such a computer based multiplexer system

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turned out, so that we decided to use a commercial counter card solution together with a powerful programming language. Therefore, Mr. Karabudak applied a PC counter card from National Instruments and learned its programming within the object oriented "Lab View" programming language, which was entirely new to him, so quickly that the envisaged multiplexer solution was realized already four weeks after project start.

Mr. Karabudaks extraordinary programming and electronic capabilities enabled him not only to add many desired flexible functions to the multiplexer, but also the realization of additional tasks. These included the programming of a complete run control software for Analytical Ultracentrifuges and a data acquisition software. All in all, in only eight weeks, Mr. Karabudak proved to quickly get into a for him completely new electronic and programming environment and realized more than we could hope even in the most optimistic estimations.

This underlines that Mr. Karabudak is a person of teal extraordinary skills in programming of electronic devices well able to very quickly adapt to new situations. Furthermore, he proved to be extremely creative as well as enthusiastic so that he brought his project forward well ahead of any schedule so that he was among the best students we had in our department so far.

Mr. Karabudak has got a friendly, easy going and reliable character so that he is well liked among the colleagues. He was very well able to communicate solely in English language in an international research group. His optimistic and energetic personality combined with his staying power in times of back strokes generally makes him very well qualified for a scientific career. We have known Mr. Karabudak as a flexible, hard-working person, eager to broaden his horizon and found discussions and work with him most stimulating and rewarding.

We were very happy to have a student like him among us and wish him the very best for his future,



Dr. habil. Helmut Cölfen  
Head of Analytical Chemistry in the Colloid  
Chemistry Department  
Head of the Biomimetic Mineralization Group



Prof. Dr. Dr. h. c. Markus Antonietti  
Director of the Colloid Chemistry Department

# Certificate

Semiconductor Products Sector

Acknowledges

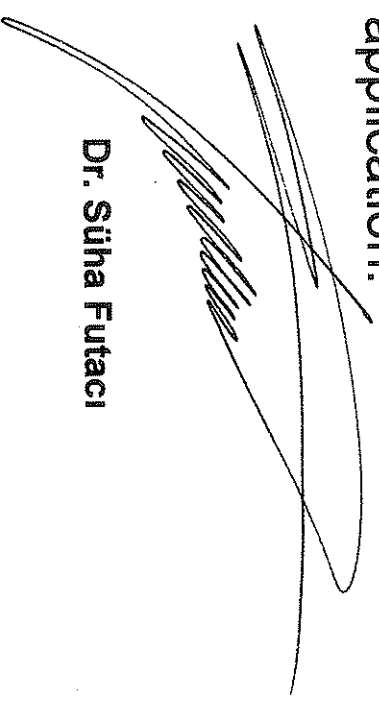
*Engin Karabudak*

for participating in the Motorola Flash Microcontroller design contest  
by developing and presenting a Microcontroller application.

Istanbul, 31<sup>th</sup> May 2002



Dr. Nihat Gabuk



Dr. Süha Futacı



**MOTOROLA**

Semiconductor Products Sector