EUROTRAINING - 316526
D2.2.2 – Train-the-Trainers courses

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START DATE AND DURATION 01/01/2013 - 36 months
ABSTRACT Deliverable D2.2.2 - This document contains the details of the 8+1 T-t-T courses completed: the description of the sites, the programmes and the evaluations of the Train-the-Trainer courses

Dissemination level PU
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1. Background

The focus of the university training is on supporting graduate schools in advanced nanoelectronics including beyond-CMOS devices. This workpackage is provide the organisation of eight two-day nanosystem awareness courses at eight sites in different East-European countries to enrich the knowledge about this topic and to give a support to those trainers and experts, who are interested in getting acquainted with educational tools that could be used for teaching their students.

The target group includes mainly those trainers and experts of electronics and related disciplines, who come from Eastern Europe. The educational tools should be concise and highly attractive, full with clear figures, animations, videos and other multimedia tools. The selection of the core content of the training is done in cooperation with the trainers. The methodology of the Train-the-Trainees (T-t-T) action is contribute to the development of partnerships between performers of training providers, research institutions and creative industries, thus promoting the well-functioning of the knowledge triangle. The research side of the knowledge triangle is promoted by the inclusion of laboratory visits, hands-on trainings, and presentations of local professors into the agenda. The innovation side of the triangle is emphasized by inviting industrial experts to lecture some novel innovations.

2. Objectives and course site overview

According to the Work Package Description, the time schedule of the organisation and the sites of the Train-the-Trainees courses are as follows:

**1\textsuperscript{st} half year:** Survey among expert professors and PhD students to determine the course core content, find the lecturers and the local laboratory to visit.

**2\textsuperscript{nd} half year:** 1\textsuperscript{st} and 2\textsuperscript{nd} T-t-T courses were held at University Politehnica of Bucharest on 7–8 October, 2013, and at the Technical University of Cluj-Napoca on 9–10 October, 2013.

**3\textsuperscript{rd} half year:** 3\textsuperscript{rd} and 4\textsuperscript{th} T-t-T courses were held at the Politehnica University of Timisoara on 9–10th April, 2014, and at the University of Novi Sad on 16–17th June, 2014.

**4\textsuperscript{th} half year:** 5\textsuperscript{th} and 6\textsuperscript{th} T-t-T courses were held at the Rzeszów University of Technology paired with IMAPS Poland 2014 conference on 23–25th September, 2014, and at the Technical University of Kosice on 25–26th September, 2014.

**5\textsuperscript{th} half year:** 7\textsuperscript{th} and 8\textsuperscript{th} T-t-T courses were held at the CEITEC Brno University of Technology on 24–25th March, 2015, and at the Warsaw University of Technology, Faculty of Mechatronics, Institute of Metrology and Biomedical Engineering on 26–27th March, 2015.

One additional (the 9\textsuperscript{th}) course was organised in pair with the 38th International Spring Seminar on Electronics Technology. This course was held in Eger on the 7\textsuperscript{th} of May, 2015.

**6\textsuperscript{th} half year:** Summary report on the evaluation of the T-t-T action, conclusions and recommendations.
3. The survey to determine the core content

3.1. Description of the survey

In order to suit the core content of the T-t-T courses to the expectations of experts, trainers and future trainers, a survey has been conducted about the topics of nanosystems, which is mainly based on the Abstract book prepared in Task 2.4 and distributed among the prospective participants.

In the questionnaire, the first group of the questions was defined in order to describe the person being questioned (i.e. professor, engineer, Ph.D. student, undergraduate student). The second group of questions focused on their general opinion and knowledge about the different topics of nanosystems. The third group of questions focused on the training materials to be included in the T-t-T courses, while the last of the questions referred to their opinion about skills & knowledge required at the moment and in 5 years-time.

The questions are detailed below.

3.2. Questions of the survey

First group:
1. Personal details:
   1.1 Title (Mr., Mrs., Dr. etc.):
   1.2 First name:
   1.3 Last name:
   1.4 Organisation:
   1.5 Department:
   1.6 Role (Ph.D. student, teacher):
   1.7 Degree (M.Sc., Ph.D. etc.):
   1.8 E-mail:

Second group:
2. Which of the following reflects your opinion about nanotechnologies best? (select one):
   I have high expectations from nanotechnologies
   I am reasonably optimistic about nanotechnologies
   I am not really convinced that the benefits justify the effort and the potential risks
   I am opposed to nanotechnologies
   I am without an opinion so far

3. Please indicate for each main field of Nanosystems how familiar you are with (5 - very familiar; 1 - not familiar at all):
   Technology, synthesis, fabrication
   Materials properties and performance
   Characterisation techniques
   Nanoelectronics and other applications
Third group:
4. Please indicate for each main field of Nanosystems how interested you are in and how gladly you would listen to it on a free seminar (5 - very much/gladly; 1 - not at all):
   Technology, synthesis, fabrication
   Materials properties and performance
   Characterisation techniques
   Nanoelectronics and other applications

5. Based on the given Abstract book, please indicate for the following lectures how gladly you would listen to it on a free seminar (5 - very gladly; 1 - not at all):

   **Technology, synthesis, fabrication**
   Stephen J. Fonash "The World of Nanotechnology: An Introduction"
   Dave Johnson "Intro to Nanofabrication: Top Down to Bottom Up"
   Helen McNally "ECET 499N: Introduction to Nanotechnology"
   Nick Fang "Illinois ME 498NF: Introduction of Nano Science and Technology"
   Nick Fang "Lecture 3: Thinking at the Nanoscale – Departure from continuum"
   Helen McNally "ECET 499N Lecture 2: Nanotechnology Background Information"
   Rashid Bashir "From Labs-on-Chips to Cellular Machines"

   **Materials properties and performance**
   Allen Kimel "Nanotechnology Impact on Materials Properties and Performance"
   Timothy S. Fisher "Thermal Energy at the Nanoscale"
   Alejandro Strachan "From Atoms to Materials: Predictive Theory and Simulations"
   Joerg Appenzeller "Lecture 4: Graphene: An Experimentalist's Perspective"

   **Characterisation techniques**
   Helen McNally "ECET 499N Lecture 12: Scanning Probe Microscopy Applications"
   Eric Stach "ECET 499N Lecture 8: Electron Microscopy"

   **Nanoelectronics and other applications**
   Stephen J. Fonash "Nanotechnology Applications in Today's World"
   Tom Morrow "Trends in Nanoelectronics: Microchips and More"
   Osama Awadelkarim "How is Nanotechnology Changing the Electronics Industry?"
   Mark Lundstrom "Nanoelectronics 101"
   Helen McNally "ECET 499N Lecture 3: Nanoelectronics 1"
   Helen McNally "ECET 499N Lecture 4: Nanoelectronics 2"
   Helen McNally "ECET 499N Lecture 5: Nanoelectronics 3"
   Supriyo Datta "ECET 499N: Nanoelectronics"
   Travis Benanti "Nanotechnology: Applications in Energy –Solar"

   **Useful tools**
   Michael Lesiecki "Nanotechnology Demos and Simulations"
   Chanaka Suranjith Rupasinghe; Mufthas Rasikim "ninithi"
Last group

6. In your opinion, what will be the main nano related skills/knowledge required at the moment? (select one or more):
   - Technology, synthesis, fabrication
   - Materials properties and performance
   - Characterisation techniques
   - Nanoelectronics
   - Nanobiotechnology, nanomedicine
   - Nanomechatronics, NEMS

7. .......and in 5 years-time?
   - Technology, synthesis, fabrication
   - Materials properties and performance
   - Characterisation techniques
   - Nanoelectronics
   - Nanobiotechnology, nanomedicine
   - Nanomechatronics, NEMS

8. Please add any additional comments (optional):

3.3. Results of the survey

The questionnaires have been filled and submitted by over 40 persons from Eastern Europe. Nearly half of them were Ph.D student, precisely, 21 and 23 persons were below and over Ph.D. degree respectively. The respondents indicated that they were very optimistic about nanosystems, and although they are not so familiar with nanosystems, they are very interested in the different topics, especially in nanoelectronics (Questions 3 and 4).

Besides, the participants indicated for all lectures how gladly they would listen to them on a free seminar. Based on the responds, the lectures aligned in decreasing order, and 4 lectures have been chosen among the most interesting lectures to deliver them on the Train-the-Trainer courses. Finally, the respondents have designated that main nano-related skills/knowledge required at the moment are about material properties and nanotechnology, while the most required skill would be about nanoelectronics and nano-biotechnology in 5 years-time. The detailed results of the survey are presented below.

2. Which of the following reflects your opinion about nanotechnologies best? (select one):

<table>
<thead>
<tr>
<th>Option</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>I have high expectations from nanotechnologies</td>
<td>19</td>
</tr>
<tr>
<td>I am reasonably optimistic about nanotechnologies</td>
<td>25</td>
</tr>
<tr>
<td>I am not really convinced that the benefits justify the effort and the potential risks</td>
<td>0</td>
</tr>
<tr>
<td>I am opposed to nanotechnologies</td>
<td>0</td>
</tr>
<tr>
<td>I am without an opinion so far</td>
<td>0</td>
</tr>
</tbody>
</table>

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3. Please indicate for each main field of Nanosystems how familiar you are with (5 - very familiar; 1 - not familiar at all):

<table>
<thead>
<tr>
<th>Field</th>
<th>avg.</th>
<th>R</th>
<th>Max</th>
<th>Min</th>
</tr>
</thead>
<tbody>
<tr>
<td>Technology, synthesis, fabrication</td>
<td>2.7</td>
<td>4</td>
<td>5</td>
<td>1</td>
</tr>
<tr>
<td>Materials properties and performance</td>
<td>2.7</td>
<td>4</td>
<td>5</td>
<td>1</td>
</tr>
<tr>
<td>Characterisation techniques</td>
<td>2.6</td>
<td>4</td>
<td>5</td>
<td>1</td>
</tr>
<tr>
<td>Nanoelectronics and other applications</td>
<td>2.9</td>
<td>4</td>
<td>5</td>
<td>1</td>
</tr>
</tbody>
</table>

4. Please indicate for each main field of Nanosystems how interested you are in and how gladly you would listen to it on a free seminar (5 - very much/gladly; 1 - not at all):

<table>
<thead>
<tr>
<th>Field</th>
<th>avg.</th>
<th>R</th>
<th>Max</th>
<th>Min</th>
</tr>
</thead>
<tbody>
<tr>
<td>Technology, synthesis, fabrication</td>
<td>3.8</td>
<td>4</td>
<td>5</td>
<td>1</td>
</tr>
<tr>
<td>Materials properties and performance</td>
<td>4.0</td>
<td>3</td>
<td>5</td>
<td>2</td>
</tr>
<tr>
<td>Characterisation techniques</td>
<td>3.9</td>
<td>4</td>
<td>5</td>
<td>1</td>
</tr>
<tr>
<td>Nanoelectronics and other applications</td>
<td>4.6</td>
<td>2</td>
<td>5</td>
<td>3</td>
</tr>
</tbody>
</table>
5. Based on the given Abstract book, please indicate for the following lectures how gladly you would listen to it on a free seminar (5 - very gladly; 1 - not at all):

6+7. In your opinion, what will be the main nano related skills/knowledge required at the moment and in 5 years-time? (select one or more):

<table>
<thead>
<tr>
<th>Skills / Knowledge</th>
<th>Now</th>
<th>5 years</th>
</tr>
</thead>
<tbody>
<tr>
<td>Technology, synthesis, fabrication</td>
<td>20</td>
<td>13</td>
</tr>
<tr>
<td>Materials properties and performance</td>
<td>25</td>
<td>11</td>
</tr>
<tr>
<td>Characterisation techniques</td>
<td>13</td>
<td>7</td>
</tr>
<tr>
<td>Nanoelectronics</td>
<td>19</td>
<td>23</td>
</tr>
<tr>
<td>Nanobiotechnology, nanomedicine</td>
<td>12</td>
<td>26</td>
</tr>
<tr>
<td>Nanomechatronics, NEMS</td>
<td>9</td>
<td>21</td>
</tr>
</tbody>
</table>
4. The Train-the-Trainer courses

The first pair of the Train-the-Trainer courses has been organised in Romania. The two sites were University Politehnica of Bucharest on 7–8 October, 2013 and the Technical University of Cluj-Napoca, on 9–10 October, 2013. The programme of the courses is developed based on the results of the survey (Section 3.) and on the Description of the Work.

4.1. Selecting the lectures for the T-t-T courses

Based on the results of the survey, the most interesting lectures are the following:

- 14: Stephen J. Fonash "Nanotechnology Applications in Today's World"
- 16: Osama Awadelkarim "How is Nanotechnology Changing the Electronics Industry?"
- 15: Tom Morrow "Trends in Nanoelectronics: Microchips and More"
- 22: Travis Benanti "Nanotechnology: Applications in Energy –Solar"
- 08: Allen Kimel "Nanotechnology Impact on Materials Properties and Performance"
- 01: Stephen J. Fonash "The World of Nanotechnology: An Introduction"
- 23: Michael Lesiecki "Nanotechnology Demos and Simulations"
- 02: Dave Johnson "Intro to Nanofabrication: Top Down to Bottom Up"

From these lectures, four of them have been chosen to deliver in the first days of the two-day Train-the-Trainer courses. The abstracts of the chosen lectures are as follows:

Stephen J. Fonash "Nanotechnology Applications in Today's World,"

http://elluminate.mesacc.edu/play_recording.html?recordingId=1277836648560_1285344098830

Abstract

Before taking a quick tour through some of today's applications of Nanotechnology, we must ask “what is so different about the nano-scale”? The answer is: small size – can get a lot of nano-things in an area or volume; most atoms are at the surface and their electron distributions are different than that of an isolated atom or that of the atoms in a bulk solid; wave properties of light become important for the small structures and nature allows some unusual chemical bonding for nano-scale structures. These opportunities available at the nano-scale should be and are used by engineers and scientists to make new materials and, from these new materials, come new devices and structures.
Abstract

For 50 years, electronics have run on silicon transistor technology. Over those years, that technology has continually been scaled down to the point now further shrinkage is difficult. Continuing evolution of electronics beyond the limits of the conventional silicon technology (top-down approach, lithography technology) requires innovative approaches for solving heat dissipation, speed and scaling issues. Many people have suggested that the microelectronics industry has to stop using top-down nanofabrication and must move to bottom-up or hybrid nanofabrication. If this worked, it would stop the spiralling costs of producing nano-scale transistors.

Tom Morrow "Trends in Nanoelectronics: Microchips and More,”

Abstract

The penetration of semiconductors into our everyday lives is accelerating, being driven by Moore's Law and Hantz's Law, the two most powerful economic and social forces of our time. Many of the same technologies and processes developed to make today's most advanced microchips are now being utilized in solar energy, LEDs (including Smart Lightning), MEMS, displays, printed, and large area electronics. Discover how nanotechnology and nanoelectronic innovations are driving today's commercial or high-reliability automotive electronics revolution and how they will shape our future.

Allen Kimel "Nanotechnology Impact on Materials Properties and Performance,”
http://elluminate.msacc.edu/play_recording.html?recordingId=1311875023430_1335458131773

Abstract

By using structure at nanoscale as a tuneable physical variable, we can greatly expand the range of performance of existing chemicals and materials. For example, ceramics, which normally are brittle, can easily be made deformable when their grain size is reduced to the low nanometre range. Switching devices and functional units at nanoscale can improve computer storage and operation capacity by a factor of a million, while nanostructured metals have greatly improved mechanical properties, both in ductility and strength. That is the reason why nanotechnology has attracted large amounts of funding, research activity and media attention.

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4.2. Promoting the Train-the-Trainer courses and registration

For promoting the Train-the-Trainer courses, a flyer and a registration form have been designed. The layout will be similar for the next courses too; the name of place, the date and the logos will be changed accordingly. The layouts of the T-t-T flyer and the registration form are illustrated below.

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Nanotechnology for Electronics
7–8 October, 2013, UPB & IMT, Bucharest, Romania

This two-day course is part of the EuroTraining project's Train-the-Trainers task, which aim is to enrich the knowledge about nanosystems and to give support to those trainers and experts, who are interested in getting acquainted with educational tools that could be used for teaching their students.

---

<table>
<thead>
<tr>
<th>Day 1.</th>
<th>Day 2.</th>
</tr>
</thead>
<tbody>
<tr>
<td>☐ 09:00–10:45 Webcasts: Nanotechnology applications and trends</td>
<td>☐ 08:30–09:15 Nanotechnology equipment development</td>
</tr>
<tr>
<td>☐ 10:45–11:00 Coffee break</td>
<td>☐ 09:15–10:00 Current research results</td>
</tr>
<tr>
<td>☐ 11:00–13:00 Webcasts: Nanotechnology in electronics and materials</td>
<td>☐ 10:00–10:15 Coffee break</td>
</tr>
<tr>
<td>☐ 13:00–13:45 Lunch break</td>
<td>☐ 10:15–12:00 Practical demonstration and laboratory visit</td>
</tr>
<tr>
<td>☐ 13:45–15:00 Novel devices, applications and trends</td>
<td>☐ 12:00–12:30 Farewell coffee with discussion and course evaluation</td>
</tr>
<tr>
<td>☐ 15:00–15:15 Coffee break</td>
<td></td>
</tr>
<tr>
<td>☐ 15:15–16:30 Applications of nanotechnology</td>
<td></td>
</tr>
<tr>
<td>☐ 16:30–16:45 Coffee break</td>
<td></td>
</tr>
<tr>
<td>☐ 16:45–17:30 Problem solving discussion</td>
<td></td>
</tr>
</tbody>
</table>

---

Fee and registration

The participation in the two-day course is free of charge. Please register by downloading and filling the registration form from the following link: [www.ett.bme.hu/eurotraining](http://www.ett.bme.hu/eurotraining) and sending it back to Zsolt Illyefalvi-Vitéz ([illye@ett.bme.hu](mailto:illye@ett.bme.hu)) or to Oliver Krammer ([krammer@ett.bme.hu](mailto:krammer@ett.bme.hu)).

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Eurotraining (GA No.: 316526) – “Provision of a European Training Infrastructure”

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Course Registration Form

University / company

Title	First Name	Last Name

Position

City	Country

Phone	E-Mail

Attending: Day 1. □ Day 2. □

Please send your registration to:

E-mail: illye@ett.bme.hu (Zsolt Illyefalvi-Vitéz) or
E-mail: krammer@ett.bme.hu (Oliver Krammer) or
(Fax: +36 1 463-4118)
4.3. Programme of the first pair of Train-the-Trainer courses

The programme of the first pair of T-t-T courses consisted several parts. At first, 4 lectures (webcasts) were delivered as an introduction to nanosystems. After that, presentations of an invited renowned scientist and of a young presenter followed. The aim of these presentations was to show, how nanosystems and nanotechnology can be lectured; what kind of methodology is effective. At last, the first day is ended with a Problem Solving Discussion with the participation of the renowned scientists, the young East-European presenter, industrial experts and the EuroTraining delegates.

The second day started with the presentation of an industrial expert and followed by the presentation and demonstration of a local scientist about up-to-date research results. Finally, the two-day courses ended with practical demonstrations and laboratory visit. The detailed programme of the first site (Bucharest) was as follows:

1st Day Program: 7th October, 2013; Course site: Campus Leu, Building B, Room 206
09:00-09:05 Introduction
09:05-10.45 Delivery of two webcasts: Nanotechnology applications and trends
  Stephen J. Fonash: “Nanotechnology Applications in Today’s World”
  Tom Morrow: “Trends in Nanoelectronics: Microchips and More”
10.45-11.00 Coffee break
11.00-13.00 Delivery of two webcasts: Nanotechnology impact on the performance of electronics and materials
13.00-13.45 Lunch break
13.45-15.00 Nanotechnology – novel devices, applications and trends - Invited renowned scientist
  János Mizsei: “Electronics, microelectronics, nanoelectronics, …”
15.00-15.15 Coffee break
15.15-16.30 Applications of nanotechnology - Young East European scientist
  Attila Bonyár: “Enhancing Biosensors with Nanotechnology”
16.30-16.45 Coffee break
16.45-17.30 Problem solving discussion – with the participation of the invited renowned scientist, the young East-European presenter, industrial experts and the EuroTraining delegates.

2nd Day Program: 8th October, 2013; Course site: Campus Leu, Building B, Room 206
08.30-09.15 Presentations about nanotechnology equipment development - Industrial expert from Raith, Germany
  Martin Kirchner: “Instrumentation and processing with electron and ion beam lithography”
09.15-10.00 Presentations about current research results - Local scientists about up-to-date research results
  Detlef Bonfert, Ciprian Ionescu: “Electronic Conductive Layers containing Nanoparticles”, including “Sensing Properties of Carbon Nanotube-Polymer Layers on Foils”
10.00-10.15 Coffee break, preparation for the laboratory visit
10.15-12.00 Practical demonstration and laboratory visit
  Visit site: Campus Grozăvești, Building JK, Rooms: 010, 011, 209, and 211
  Visit to the Department of Metallic Materials Science and Physical Metallurgy and the Biomaterials Research Centre (BioMat http://www.biomat.ro/) at the Materials Science and Engineering Faculty, UPB.
12.00-12.30 Farewell coffee with discussion and course evaluation
12.30 Disperse

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Based on the experiences of the course held in Bucharest, some of the webinars were omitted at the next site (Cluj-Napoca) and more time was given to the live presentations. Two local young scientists were invited too to give an overview about their scientific research. The topics (short abstract) of the local young scientists in Cluj-Napoca were the following:

**Mihai Gabor: “Spintronic devices for sensor and data storage applications”**

**Abstract:**

The manipulation of the spin degree of freedom in solid-state systems and the study of the related physical phenomena generated, over the last decades, a rapidly emerging field of science and technology: the spintronics. The discovery of Giant Magnetoresistance effect (GMR) and Tunneling Magnetoresistance (TMR) effect in multilayer structures radically changed the data storage technology. Nowadays, the MTJs constitute the elementary bricks of different magnetic random-access memories (MRAM) prototypes, field sensors and read-heads in HDD hard disk drives or high frequency oscillators. Within the extremely dynamic research field of spintronics, ongoing studies are focused on elaboration and study of new materials and devices with customized magnetic and spin dependent transport properties.

**Traian Petrișor Jr. “Alternative methods for nanolithography”**

**Abstract:**

Two paths are presented for the fabrication of nano-scale objects. They represent alternatives to the other well-established techniques currently used in nano-fabrication. The first consists in the use of self-assembled polystyrene nano-spheres correlated with ion beam etching, for defining different nanometric geometries. The second makes use of the micro-domain separation of diblock copolymers in order to produce nanometric lithographic mask for the ion beam etching of thin films or multilayers. The presentation focuses on the results, current research status and issues regarding the described techniques.
Thus, the programme for the T-t-T course in Cluj-Napoca was:

1st Day Program: 9th October, 2013; Course site: Aula Domsa, 15 Str Constantin Daicoviciu, UTCN

09:00-09:30 Introduction
09.30-10.45 Delivery of a webcast: Nanotechnology impact on the performance of electronics and materials
   Osama Awadelkarim: “How is Nanotechnology Changing the Electronics Industry?”
10.45-11.00 Coffee break
11.00-13.00 Nanotechnology – novel devices, applications and trends - Invited renowned scientist
   János Mizsei: “Electronics, microelectronics, nanoelectronics, …”
13.00-14.00 Lunch break
14.00-15.15 Applications of nanotechnology - Young East European scientist
   Attila Bonyár: “Enhancing Biosensors with Nanotechnology”
15.15-15.30 Coffee break
15.30-16.45 Presentations about nanotechnology equipment development - Industrial expert from Raith, Germany
   Martin Kirchner: “Instrumentation and processing with electron and ion beam lithography”
16.45-17.00 Problem solving discussion – with the participation of the invited renowned scientist, the young East-European presenter, industrial experts and the EuroTraining delegates.

2nd Day Program: 10th October, 2013; Course site: Aula Domsa, 15 Str Constantin Daicoviciu, UTCN

08.30-10.00 Presentations about current research results - Local scientists about up-to-date research results
   Mihai Gabor: “Spintronic devices for sensor and data storage applications”
   Traian Petrişor Jr. “Alternative methods for nanolithography”
10.00-10.15 Coffee break, preparation for the laboratory visit
10.15-12.00 Practical demonstration and laboratory visit
   Visit to the Center of Superconductivity, Spintronics and Surface Science (C4S), Faculty of Materials Science and Engineering at the Technical University of Cluj-Napoca (TUCN), http://www.c4s.utcluj.ro
10.15-12.00 Practical demonstration and laboratory visit
12.00-12.30 Farewell coffee with discussion and course evaluation
12.30 Disperse.
4.4. Evaluation of the courses and experiences

For evaluating the courses, an evaluation form was designed. The evaluation form was distributed among the participants after the two-day courses and the results have been summarised. The layout of the course evaluation form is illustrated below:

**Nanotechnology for Electronics**

9–10 October, 2013, Technical University of Cluj-Napoca, Romania

What do you think?

Thank you for answering the following questions and for sending back this form to Zsolt Illyefalvi-Vitéz illye@ett.bme.hu or to Oliver Krammer krammer@ett.bme.hu.

Please mark each question from 1 (very bad) to 10 (excellent).

<table>
<thead>
<tr>
<th>Organisation:</th>
<th>Grade</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Course location, city</td>
<td>10</td>
<td></td>
</tr>
<tr>
<td>Classroom and technical equipment</td>
<td>10</td>
<td></td>
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<tr>
<td>Coffee breaks</td>
<td>10</td>
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<table>
<thead>
<tr>
<th>Course:</th>
<th>Grade</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Course content (compared to your expectations)</td>
<td>10</td>
<td></td>
</tr>
<tr>
<td>Proportion of theoretical and practical issues</td>
<td>10</td>
<td></td>
</tr>
<tr>
<td>Course material (presentation, etc.)</td>
<td>10</td>
<td></td>
</tr>
<tr>
<td>How useful was the course for your studies?</td>
<td>10</td>
<td></td>
</tr>
<tr>
<td>How well would the course help you in teaching?</td>
<td>10</td>
<td></td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Lecture types:</th>
<th>Grade</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Webinar</td>
<td>10</td>
<td></td>
</tr>
<tr>
<td>Presentation of scientists (young, renowned, local)</td>
<td>10</td>
<td></td>
</tr>
<tr>
<td>Presentation of industrial representative</td>
<td>10</td>
<td></td>
</tr>
<tr>
<td>Lab tours</td>
<td>10</td>
<td></td>
</tr>
</tbody>
</table>

Your occupation: [ ] student [ ] Ph.D. student [ ] senior scientist [ ] engineer [ ] other

Your professional / educational field: [ ] Electronics [ ] Electronics technology [ ] Communications [ ] Semiconductor science [ ] Material science [ ] other

Further remarks and suggestions (optional):

*Thanks for your help!*
Results of the course evaluation

Some characteristics comments from the evaluations:

General comments:
Very interesting indeed. The Webinar idea is very useful and less expensive.
Thank you for opportunity to learn from this course!
It was a pleasure to participate in the EuroTraining course entitled "Nanotechnology for Electronics", held between 9-10 Oct 2013, at the Technical University of Cluj-Napoca.
The "Nanotechnology for Electronics" course was very useful for understanding the latest news in nanotechnology and the bridges of it with electronics. I highly appreciate this type dissemination course.

Useful comments from the evaluation forms to some categories:

Organisation / Course location, city
Location was chosen very well

Organisation / Coffee breaks
The coffee breaks were too short and the courses were very long. After 1 course of 2h one break is necessary

Course / Course content (compared to your expectations)
Very interesting
Full with novelties

Course / Proportion of theoretical and practical issues
Maybe more theoretical issues were necessary

Course / Course material (presentation, etc.)
The online presentations were very difficult to be followed
Too bad the audio for the first presentation was not very clear

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Comprehensive and very well realised

Course / How useful was the course for your studies?
Useful for me, I have some lessons in field of nanostructured materials
Very useful
Can be used for master level

Course / How well would the course help you in teaching?
I think the materials presented are too advanced for teaching at BSc, rather address MsC or PhD levels.
It helps me significantly in teaching

Lecture types / Webinar
Comprehensive and very well realised

Lecture types / Presentation of scientists (young, renowned, local)
We were happy to see local developments included in the presentations.
High quality presentations

Lecture types / Presentation of industrial representative
Very interesting

Lecture types / Lab tours
We visit only characterisation labs, maybe some electronic labs were more interesting
Very interesting

Summary of the experiences

The experiences of the first pair of Train-the-Trainer courses were as follows:

- the courses were successful with approximately 35–40 participants on each event;
- the live presentation drew more attention than the webcasts, that was why a corrective action was taken to the second site, Cluj-Napoca;
- the local renowned scientists could deliver very good lectures and the presentations of the local young-scientist were very interesting also.
- The course participants (mainly from the field of electronics) greatly appreciated to get acquainted with nano/technology related disciplines which highly influences the electronics itself.
- The practical demonstrations and lab visits were very successful too.

Links for the 1st and 2nd Train-the-Trainer courses:

T-t-T Flyer - Bucharest, 7-8 October, 2013;

T-t-T Course Program - Bucharest, 7-8 October, 2013;

T-t-T Flyer - Cluj-Napoca, 9-10 October, 2013;

T-t-T Course Program - Cluj-Napoca, 9-10 October, 2013;
4.5. 3\textsuperscript{rd} and 4\textsuperscript{th} Train-the-Trainer courses

The 3\textsuperscript{rd} and 4\textsuperscript{th} T-t-T course were held at the Politehnica University of Timisoara (9–10th April, 2014) and at the University of Novi Sad (16–17th June, 2014). The first day of the 3\textsuperscript{rd} course started with the presentation of the renowned scientist, János Mizsei, and then continued with the presentations of the industrial representative and the young scientist: Martin Kirchner and Attila Bonyár respectively. In the second day, the practical demonstration was organised in Continental Automotive Romania SRL, where the laboratory equipment used for qualifying automotive electronic products was presented. The equipment for life-time tests was especially attractive. In Novi-Sad, the industrial representative was Hervé Fanet from CEA-LETI, and the practical demonstration is focused on printable electronics.

The programme of the 3\textsuperscript{rd} course in Timisoara was:

\textbf{1\textsuperscript{st} Day Program: 9\textsuperscript{th} April, 2014} \hspace{1cm} \textbf{Course site: Continental Automotive Romania SRL}

<table>
<thead>
<tr>
<th>Time</th>
<th>Session</th>
</tr>
</thead>
<tbody>
<tr>
<td>13.00-13.15</td>
<td>Introduction</td>
</tr>
<tr>
<td>14.45-15.00</td>
<td>Coffee break</td>
</tr>
<tr>
<td>15.00-16.15</td>
<td>Presentations about nanotechnology equipment development - Industrial expert from Raith, Germany Martin Kirchner: “Instrumentation and processing with electron and ion beam lithography”</td>
</tr>
<tr>
<td>16.15-17.15</td>
<td>Applications of nanotechnology - Young East European scientist Attila Bonyár: “Enhancing Biosensors with Nanotechnology”</td>
</tr>
<tr>
<td>17.15-17.30</td>
<td>Problem solving discussion – with the participation of the invited renowned scientist, the young East-European presenter, industrial experts and the EuroTraining delegates.</td>
</tr>
</tbody>
</table>

\textbf{2\textsuperscript{nd} Day Program: morning, 10\textsuperscript{th} April, 2014} \hspace{1cm} \textbf{Course site: Continental Automotive Romania SRL}

<table>
<thead>
<tr>
<th>Time</th>
<th>Session</th>
</tr>
</thead>
<tbody>
<tr>
<td>10.00-13.00</td>
<td>Practical demonstration: Visit to Continental Automotive Romania</td>
</tr>
</tbody>
</table>

\textbf{2\textsuperscript{nd} Day Program: afternoon, 10\textsuperscript{th} April, 2014} \hspace{1cm} \textbf{Course site: Politehnica University of Timisoara (senate room)}

<table>
<thead>
<tr>
<th>Time</th>
<th>Session</th>
</tr>
</thead>
<tbody>
<tr>
<td>14.15-14.30</td>
<td>Welcome from universities</td>
</tr>
<tr>
<td>14.30-15.10</td>
<td>Alain Michel: „The role of simulation in high performance electronic design”</td>
</tr>
<tr>
<td>15.10-15.50</td>
<td>Bálint Medgyes: „Dendrites: Secret Pests in Microelectronics”</td>
</tr>
<tr>
<td>15.50-16.30</td>
<td>Alexander Neufeld: „Smart electronics in home appliances”</td>
</tr>
<tr>
<td>16.30-17.00</td>
<td>Networking break</td>
</tr>
<tr>
<td>17.00-17.40</td>
<td>Zsolt Illyefalvi-Vitéz: „Life-time prediction of Soldered Joints”</td>
</tr>
<tr>
<td>17.40-18.20</td>
<td>Ioan Plotog: „DFM concept integrated in the predicted Life Cycle of a new product”</td>
</tr>
<tr>
<td>18.20-19.00</td>
<td>Balázs Illés: „Nano-characterisation in tin whisker research”</td>
</tr>
<tr>
<td>19.00-19.30</td>
<td>Farewell coffee with discussion and course evaluation</td>
</tr>
</tbody>
</table>

Some photos about the course in Timisoara are presented below:
The evaluation of the course is can be found in the following plot. The course obtained very good scores between 8.6 and 9.8:
The programme of the 4th course in Novi Sad was as follows. The delivery of webcast was excluded because of the high interest and long discussion about the topics of live presentations:

1st Day Program: 16th June, 2014 – Course site: Centre for Integrated Microsystems and Components – CIMC

10.30-10.45 Introduction
10.45-11.45 Nanotechnology – novel devices, applications and trends
   László Juhász: „Electronics, microelectronics, nanoelectronics, …”
11.00-12.45 Novel devices, applications and trends - Invited renowned scientist
   Goran Radosavljević: „LTCC materials and their application for realization of Passive Components and Sensor Systems”
12.45-13.45 Lunch break
13.45-15.00 Presentations about innovations for industry – expert from CEA-LETI, France
   Hervé Fanet: „Energy efficient nanoelectronics”
15.00-16.00 Delivery of a webcast: Nanotechnology impact on the performance of electronics and materials
   Osama Awadelkarim: „How is Nanotechnology Changing the Electronic Industry?”
16.00-16.15 Coffee break
16.15-17.15 Applications of nanotechnology - Young East European scientist
   Attila Bonyár: “Enhancing Biosensors with Nanotechnology”
17.15-17.30 Problem solving discussion – with the participation of the invited renowned scientist, the young East-European presenter, industrial experts and the EuroTraining delegates.

2nd Day Program: 17th June 2014 – Course site: Centre for Integrated Microsystems and Components – CIMC

08.30-10.00 Presentation of local scientists about up-to-date research results
   Aleksandar Menićanin: „Inkjet Printed Layers with Nanoparticle Silver on Polyimide Substrate”
   Nelu Blaž: „Various types of Displacement Sensors”
   Čedo Žlebič: „Comparison of Resistive and Capacitive Strain Gauge Sensors Printed on Polyimide Substrate Using Ink-Jet Printing Technology”
   Djordije Tripkovic: „Preparation of BaTiO3 sols suitable for thin films fabrication using inkjet printing process”
10.00-10.30 Coffee break
10.30-12.00 Practical demonstration and laboratory visit – Visit to the Laboratories of CIMC, at the Faculty of technical Sciences, University of Novi Sad, Republic of Serbia, http://www.cimc.rs/
12.00-12.30 Farewell coffee with discussion and course evaluation

Some photos about the course in Novi Sad are presented below:
The evaluation of the course is can be found in the following plot. The course obtained very good scores between 8.7 and 10:

![Course evaluation plot](image)

**Links for the 3rd and 4th Train-the-Trainer courses:**

T-t-T Flyer - Timisoara, Romania, 9 - 10 April 2014;  
http://www.eurotraining.net/pdf/EuroTraining_Flyer_Timisoara_9_10_April_2014.pdf

T-t-T Course Program - Timisoara, Romania, 9 - 10 April 2014;  

T-t-T Flyer - Novi Sad, Serbia, 16 - 17 June 2014;  

T-t-T Course Program - Novi Sad, Serbia, 16 - 17 June 2014;  
4.6. 5th and 6th Train-the-Trainer courses

The 5th and 6th T-t-T courses were at the Rzeszów University of Technology paired with IMAPS Poland 2014 conference (23–25th September, 2014) and at the Technical University of Kosice (25–26th September, 2014). In the 5th course, after the course day at IMAPS Poland, the practical demonstration was organised in the laboratory of Department of Electronics and Communication Systems - Politechnika Rzeszowska. The laboratory is well equipped for investigating thick-film technology and nano particle added inks. In the 6th course, the practical demonstration included the presentation of the most recent research results in the field of Organic Large Area Electronics and printable electronics. The programme of the 5th course in Czarna and Rzeszów was:

1st Day Program: 23rd September, 2014  
Course site: IMAPS CPMT Conference, Czarna, Poland

10.15-10.30 Introduction
10.30-11.00 Presentations about current research results – Presentation of local scientists
  Wróblewski, Grzegorz: „Carbon nanomaterials dedicated to PV module heating system”
11.00-11.30 Coffee break
11.30-13.00 Poster Presentations of papers selected from the IMAPS CPMT conference
  Allaf, Kamil Nouri: „Application of molecular modelling in micro and nano material technologies”
  Izydorczyk, Weronika: „Microstructure and NO2 gas-sensing properties of SnO2 thin films and nanowires”
  Grzegorz Błąd: „Modification of Liquid Crystalline Phases by Nanomaterial Dopants for the Electronic Devices Elements”
  Illyefalvi-Vitez, Zsolt: “Global Networks on Nanotechnology Education”
  Wyżkiewicz, Iwona: „Graphene inks for industrial printing techniques”
  Sobaszek, Michał: „High refractive index ultra-thin nanocrystalline boron doped diamond film for NIR waveguiding”
  Falat, Tomasz: „Low-temperature sintered nano-silver based thermal interface materials”
  Wróblewski, Grzegorz: „Spray coated graphene nanoplatelets and carbon nanotubes oriented in constant electric field for transparent and elastic electrodes”
  Krammer, Oliver: „Micro- and nano characterisation of intermetallics in lead-free solder joints”
  Futera, Konrad: „Inkjet printed microwave circuits on flexible substrates using heterophase graphene based inks”
  Tomaszewski, Grzegorz: „Investigation of ink spreading on various substrates in inkjet technology”

2nd Day Program: 24th September, 2014  
Course site: IMAPS CPMT Conference, Czarna, Poland

9.00-9.15 Introduction
9.10-9.50 Nanotechnology – novel devices, applications and trends – Presentation of an invited renowned scientist
  Mizsei, János: „Electronics, microelectronics, nanoelectronics”
9.50-10.30 Presentations about nanotechnology equipment development - Industrial expert from Raith, Germany
  Kirchner, Martin: “Instrumentation and processing with electron and ion beam lithography”
10.30-10.50 Coffee break
10:50-11:30 Applications of nanotechnology - Young East European scientist
  Bonyár, Attila: “Enhancing Biosensors with Nanotechnology”
11:30-12:00 Presentations about current research results – Presentation of local scientists
  Bogdanowicz, Robert: „Deposition of nanocrystalline boron-doped diamond onto epitaxial GaN films for high power electronic and optoelectronic devices”
12:00-12:20 Problem solving discussion

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3rd Day Program: 25th September, 2014  
Course site: Dept. of Electr. and Com. Systems, PRZ, Rzeszów

9:00-9:40  
Presentations about current research results – Presentation of local scientists  
Tomaszewski, Grzegorz: “Investigation of ink spreading on various substrates in inkjet technology”

9.40-11.10  
Practical demonstration and laboratory visit – Visit to the laboratories of the Department of Electronic and Communication Systems, Politechnika Rzeszowska, Rzeszów, Poland

11.10-11.30  
Farewell coffee with discussion and course evaluation

Some photos about the course in Czarna and Rzeszów are presented below:
The evaluation of the course is can be found in the following plot. The course obtained very good scores between 9 and 10:

![Course evaluation chart]

The programme of the 6th course in Kosice was as follows.

**1st Day Program: 25th September, 2014 – Course site: Department of Technologies in Electronics, TU Kosice**

16.00-16.10  Introduction
16.10-16.50  Nanotechnology – novel devices, applications and trends - Presentation of an invited renowned scientist
  \[János Mizsei: \textit{Electronics, microelectronics, nanoelectronics, …}\]
16.50-17.30  Nanoelectronics – novel applications - Presentation of an invited renowned scientist
  \[Martin Kmec: \textit{M-Sequence based UWB sensing systems}\]
17.30-17.40  Coffee break
17:40-18:20  Presentations about nanotechnology equipment development - Industrial expert from Raith, Germany
  \[Martin Kirchner: \textit{Instrumentation and processing with electron and ion beam lithography}\]
18.20-19.00  Applications of nanotechnology - Young East European scientist
  \[Attila Bonyár: \textit{Enhancing Biosensors with Nanotechnology}\]
2nd Day Program: 26th September 2014 – Course site: Department of Technologies in Electronics, TU Kosice

09.00-9:40  Presentations about current research results - Presentation of a local renowned scientist
Alena Pietrikova: “Reliability aspects of lead-free solders applied in electronics”

9:40-10:20  Presentations about current research results - Presentation of an invited senior scientist
Aleksandar Menićanin: „Inkjet Printed Layers with Nanoparticle Silver on Polyimide Substrate - CPW Inductors”

10.40-11.20 Presentations about current research results - Presentation of an invited young scientist
Djordjije Tripkovic: „Preparation of BaTiO3 sols suitable for thin films fabrication using inkjet printing process”

11.20-12.00 Presentations about current research results - Presentation of a local senior scientist
Ľubomír Livovský: „PCB design with embedded resistors”

12.00-12.30 Problem solving discussion – with the participation of the invited and local scientists and the EuroTraining delegates.

12.30-13.30 Lunch break

13.30-14.00 Current research results, running projects and future plans – free discussion of all participants with the research staff of the Department of Technologies in Electronics

14.00-14.45 Practical demonstration and laboratory visit – Presentation of the virtual and research labs. of the Dept.

14.45-15.00 Farewell coffee with discussion and course evaluation

15.00 Disperse

Some photos about the course in Kosice are presented below:
The evaluation of the course is can be found in the following plot. The course obtained very good scores between 8.5 and 10:

**Links for the 5th and 6th Train-the-Trainer courses:**


4.7. 7th and 8th Train-the-Trainer courses

The 7th and 8th T-T-T courses were at the CEITEC Brno University of Technology (24–25th March, 2015) and at the Warsaw University of Technology, Faculty of Mechatronics, Institute of Metrology and Biomedical Engineering (26–27th March, 2015). In Brno, besides the presentations of scientists, the practical demonstration is focused in the field of synthetizing and characterising nanoscale features for nanoelectronics. In Warsaw, the Laboratory of Vacuum Deposition of Thin Films, the Laboratory of Chemical and Thermal Processing, the Laboratory of Photolithography and the Laboratory of Inspection and Testing have been visited.

The programme of the 7th course in Brno was:

1st Day Program: 24th March, 2015  Course site: CEITEC, Brno
14:00-14:10  Introduction
14:10-15:00  Nanotechnology – novel devices, applications and trends – Presentation of an invited renowned scientist
Mizsei, János: „Electronics, microelectronics, nanoelectronics”
15:00-15:50  Presentations about current research results – Presentation of invited renowned scientists
Pavel Neužil: „MEMS technology and applications”
15:50-16:10  Coffee break
16:10-17:10  Presentations about nanotechnology equipment development - Industrial expert from Raith, Germany
Kirchner, Martin: “Instrumentation and processing with electron and ion beam lithography”
17:10-17:50  Applications of nanotechnology - Young East European scientist
Bonyár, Attila: “Enhancing Biosensors with Nanotechnology”

2nd Day Program: 25th March, 2015  Course site: CEITEC, Brno
09:00-10:20  Presentations about current research results – Presentation of local scientists
Michal Urbánek: „Controlling spin vortex states in magnetic nanodisks by magnetic field pulses”
Martin Vala: „Organic Electronics and Photonics: Applications and Materials”
10:20-10:40  Coffee break
10:40-12:00  Presentations about current research results – Presentation of local scientists
Jiří Šmarhák: „Computer simulation of nanostructures”
Petr Klenovský: „Controlling properties of the semiconductor quantum dots for their usage in the information technology”
13:00-13:30  Introduction to the laboratory visit
David Skoda - Head of Core Facility and Centre of Laboratories
13:30-16:00  Visit to the CEITEC BUT core facilities – Practical demonstration and laboratory visit
Clean room at Faculty of Mechanical Engineering, Technická 2, 616 00 Brno
Laboratory of research group Smart Nanodevices, Technická 2, 616 00 Brno
Clean room and laboratories at Faculty of Science, Masaryk University Kotlářská 9, 602 00 Brno
16:00-16:30  Farewell coffee with discussion and course evaluation
The lecture room will be opened from 15.30. The attendance can use it up to their arrival from the laboratory visits.
Some photos about the course in Brno are presented below:

The participants

The renowned scientist

The local scientist

Lab visit

The evaluation of the course is can be found in the following plot. The course obtained very good scores between 7.8 and 9.5:
The programme of the 8th course in Warsaw was:

1st Day Program: 26th March, 2015 – Course site: Institute of Metrology and Biomedical Engineering, WUT

08:30-08:40 Introduction
08:40-09:40 Nanotechnology – novel devices, applications and trends - Presentation of an invited renowned scientist
János Mizsei: „Electronics, microelectronics, nanoelectronics, …”
09:40-10:40 Marcin Słoma: „Nanoscale materials for large-scale electronics”
10:40-11:00 Coffee break
11:00-12:00 Presentations about nanotechnology equipment development - Industrial expert from Raith, Germany
Martin Kirchner: “Instrumentation and processing with electron and ion beam lithography”
12:00-12:40 Applications of nanotechnology - Young East European scientist
Attila Bonyár: “Enhancing Biosensors with Nanotechnology”
12:40-13:40 Lunch break
13:40-14:40 Presentations about current research results - Presentation of local young scientist
Grzegorz Wróblewski: „Carbon nanomaterials in flexible and transparent applications”
14:40-15:20 Presentations about current research results - Presentation of local senior scientist
Konrad Kielbasiński: „Nanofibers Sintered Joints on Rigid and Flexible Substrates”
15:20-15:30 Problem solving discussion

2nd Day Program: 27th March, 2015 – Course site: Institute of Electron Technology, Warsaw, Poland

09:00-09:30 Presentations about current research results - Presentation of local young scientist
Marek Ekielski: „Nanoimprint lithography”
09:30-10:00 Presentations about current research results - Presentation of local scientist
Marcin Juchniewicz: „Current research results – introduction to the laboratory visit”
10:00-12:00 Visit to the Nanotechnology Laboratory of the Institute of Electron Technology – Practical demonstration and laboratory visit
The Laboratory of Vacuum Deposition of Thin Films
The Laboratory of Photolithography
12:00-12:10 Evaluation and dispersion

Some photos about the course in Warsaw are presented below:

![The participants](image1.jpg)
![Lab visit](image2.jpg)
The evaluation of the course is can be found in the following plot. The course obtained very good scores between 7.8 and 10:

Links for the 7th and 8th Train-the-Trainer courses:

T-t-T Flyer Brno 24-25 March 2015;

T-t-T Course Program Brno 24-25 March 2015;

T-t-T Flyer Warsaw 26-27 March 2015;

T-t-T Course Program Warsaw 26-27 March 2015;
4.8. The 9th Train-the-Trainer course

Due to the great success of the previous courses, organisation of an additional course was determined. The 9th EuroTraining Train-the-Trainers “Nanotechnology for Electronics” course was organized in the frame of the ISSE2015 Seminar (6–10th May, 2015). Relevant presentations were selected and included into the Thursday program to form an interesting course.

The programme of the 9th course in Eger was:

1st Day Program: 7th May, 2015 – Course site: Egerszalók, hosted by BME-ETT

08:45-09:00  Opening
09:00-10:30  Oral Session 1
Karlheinz Bock: “Heterointegration of Multifunctional Systems”
Csaba Szabó: “Advanced Automotive Electronics Development at Bosch Engineering Center Budapest”
Andrzej Dziedzic: “Low-Temperature Properties of Capacitors Embedded into Printed Circuit Boards”
Arne Neiser: “Placement of Embedded Temperature Sensors in a Printed Circuit Board for a Manufacturing”
10:30-11:00  Coffee break
11:00-13:00  Oral session 2
James E. Morris: “Nanomanufacturing R&D for Electronics Packaging”
József Gyalai: “More than Moore, how much more?”
Goran Miskovic: “Grain Size and Porosity Dependence of Titanium Dioxide Nanopaste on Sintering Temperature for Gas Sensing Application”
Ievgen Kharabet: “Study of Carbon-Fiber-Reinforced Polymers Conductivity’s Dependence on a Mechanical Strain”
Beatrice Miccoli: “Interface of a Single ZnO-Nanowire Assembled onto Custom-Fabricated Nanogap Device for UV Sensing Applications”
13:00-14:00  Lunch
14:00-16:00  Oral session 3
János Mizsei: “Electronics, Microelectronics, Nanoelectronics…”
Hervé Fanet: “Energy Efficient Nanoelectronics”
Éva Jelinek: “Thermal-Electronic Devices and Thermal-Electronic Logic Circuits (TELC)”
Jiri Navratil: “Perspective Methods of Creating Conductive Paths by Aerosol Jet Printing Technology”
16:00-16:15  Coffee break
16:15-18:00  Poster session 1 – selected posters in the field of nanotechnology
J. Stulik: “Carbon Nanotube Dispersion Preparation and Deposition of Thin Layers for Gas Sensors”
B. Illés: “Relation between Tin Whiskering Ability Sn/Ag/Cu Solder Alloys and Current Load”
B. Medgyes: “Corrosion investigations on Lead-Free Micro-alloyed Solder Alloys used in Electronics”
E. Ceuca: “The Smart City - Integrated green energy system”
P. Lukacs: “UWB Antenna Based on Nanoparticles of Silver on Polyimide Substrate”
Č. Žlebič: “Electrical Properties of Inkjet Printed Graphene Patterns on PET-based Substrate”
A. Bonyár: “Enhancing Plasmonic Biosensors with Nanotechnology”

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J. Kámán: “Investigation of Surface Mechanical Properties of the Copper-Solder Interface by Atomic Force Microscopy”
T. Blecha: “Measurement System for Sensitive Layers of Carbon Nanotubes”
N. Nenov: “Examination and Development of Specialized Force Sensor”
L. Niţă: “Software for a Bidirectional Communication System for Neuromotor Disabled Patients”
R.G. Bozomitu: “Pupil Centre Coordinates Detection Using the Circular Hough Transform Technique”
M. Marinov: “Improvement of NDIR Carbon Dioxide Sensor Accuracy”
M. Kiscic: “Flexible Inkjet Printed Sensor for Liquid Level Monitoring”
N. Blaž: “Displacement Sensor Based on Interdigital Capacitor”
J. Somer: “Development of Optical Inclinometer in LTCC Technology”
A. Damilano: “A Flexible Resistive Read-Out Circuit Suitable to Multi-purpose ZnO Nanostructured Transducers for Robotic Applications”
C. Ionescu: “A SPICE Model for Electroluminescent Foils”

Some photos about the course in Eger are presented below:
The evaluation of the course is can be found in the following plot. The course obtained very good scores between 8.3 and 10:

![Bar chart showing course evaluation scores.](image)

*Links for the 9th Train-the-Trainer course:*

T-t-T Flyer Eger 6-10 May 2015;  

T-t-T Course Program Eger 6-10 May 2015;  
4.9. Testimonial

**EuroTraining supporting the higher education in Eastern Europe**

Over the years EuroTraining has offered more than 20 Train-the-Trainers courses in Eastern Europe from Warsaw in north to Sofia in south. The aim of this training is to transfer training experience from leading European universities to the professors, PhDs and postdocs who will form the next generation curricula at Eastern European universities. A total of more than 600 potential faculty members have achieved training and received training material in the most advanced subjects of micro-/nano technologies.

Some of the Chairs of the organizing universities honoured the Train-the-Trainers courses by sharing their valuable opinions with us, as follows:

([http://www.eurotraining.net/pdf/Testimonial_TtT_courses.pdf](http://www.eurotraining.net/pdf/Testimonial_TtT_courses.pdf))

**Prof. Paul Svasta, Politehnica University of Bucharest:**

At the EuroTraining course our students and young scientists got acquainted with the trends in micro- and nanoelectronics and gained also insight into the possibilities and efforts at our university. At the same time, thanks to Euro Training courses, numerous students from several technical universities in Romania had the opportunity to improve their technical knowledge.

**Prof. Dan Pitica, Technical University of Cluj-Napoca:**

It was very interesting for our students of the electronics department to listen to the nanotechnology presentation of an industrial expert and then to see it in practice in the laboratories of our sister department.

**Mr. Cosmin Moisa, Group Leader for Electronics Development at Continental Timisoara:**

It was our pleasure to accept the visit of nearly hundred students, academics and engineers to our high tech automotive electronics design centre and the unique, world-class, and very well-equipped life-time test facilities. The seminars held for our engineers and university researchers have brought us closer to the nonautomotive environment and prepared us for upcoming technologies.

**Prof. Mirjana Damnjanović, Centre for Integrated Microsystems and Components, University of Novi Sad:**

The seminar type organization of the Train-the-Trainers course provided a good opportunity for our young and senior scientists to present their research results and have a live discussion with renowned foreign professors and industrial experts.

**Prof. Jerzy Potenczki, Head of Department of Electronic and Communication Systems, Rzeszów University of Technology:**

The inclusion of the EuroTraining course into the program of the IMAPS Poland conference brought the expected benefits for both events. It was gratifying to see the large number of Polish and foreign contributors with nanoelectronics and nanotechnology topics, as well as, the great interest for our new nanotechnology laboratories in the Rzeszów campus. I would like to express my personal thanks for the excellent cooperation on the line Rzeszów-Budapest during the organization.

**Prof. Alena Pietrikova, Technical University of Košice:**

On behalf of the Slovak group, I would like to thank for having brought and managed the EuroTraining course in Kosice. We appreciated the contributions of young scientists from the surrounding countries, from Germany, Hungary, and Serbia, which – together with the Slovak presentations – provided nice experiences for our young people. We would be happy, if it initiated further cooperation.