



**UMK Center for New Materials  
at Helsinki University of Technology, TKK**

*in Brief*

*[www.umk.fi](http://www.umk.fi)*

October, 2009

# UMK Center for New Materials

- The *UMK Center for New Materials* is a cross-disciplinary research institute across the Faculty and Department borders at Helsinki University of Technology, TKK. Professors from different Faculties and Departments including their research groups participate in the activities as members
- Currently the UMK Center for New Materials has **32 members from 12 Departments and 4 Faculties**. The members own the research equipment and facilities. The UMK Center for New Materials concentrates on developing collaboration and making new cross-disciplinary initiatives, which do not relate to any specific Department or Faculty
- The UMK Center for New Materials has special **role in supporting the social impact** of research

# Benefits of the UMK Center for New Materials (1)

- *UMK Center for New Materials* is a **common platform and brand** for material and related research at TKK
- **Information channel** (UMK Newsletter, [www.umk.fi](http://www.umk.fi))
- Easier **access to expertise** in different UMK Center for New Materials member laboratories
- Forum for **networking**
- Contributes to **more efficient use of equipment and facilities** (e.g. coordinated purchases and improved user access of research equipment)
- **Neutral**, not linked to specific Departments or Faculties (broader perspective)

## Benefits of the UMK Center for New Materials (2)

- **“New materials, applications and commercialization”**, five day intensive course for selected scientifically oriented young researchers
- **Colloquium on New Materials** (open, multidisciplinary weekly seminar)
- **Materials Invention Award** to promote the creation of high quality innovations from basic research (initiated by the UMK Center for New Materials)
- Is a **platform for new initiatives** (e.g. in innovation policy)

# Selected Recent Papers (1)

- K. Lindfors, A. Priimagi, T. Setälä, A. Shevchenko, A. T. Friberg, **M. Kaivola**, Local polarisation of tightly focused unpolarized light, *Nature Photonics* 1, 228 (2007).
- A. G. Nasibulin, P. V. Pikhitsa, H. Jiang, D. P. Brown, A. V. Krasheninnikov, A. S. Anisimov, P. Queipo, A. Moisala, D. Gonzalez, G. Lientschnig, A. Hassanien, S. D. Shandakov, G. Lolli, D. E. Resasco, M. Choi, D. Tománek, **E. I. Kauppinen**, A novel hybrid carbon nanomaterial, *Nature Nanotech*, 2, 156 (2007).
- **J. P. Pekola**, J. J. Vartiainen, M. Möttönen, O.-P. Saira, M. Meschke, D. V. Averin, Hybrid single-electron transistor as a source of quantized electric current, *Nature Physics* 4, 120 (2008).
- P. Alitalo and **S. Tretyakov**, Electromagnetic cloaking with metamaterials, *Materials Today* 12, 22 (2009).
- M. Rinkiö, A. Johansson, G.S. Paraoanu, **P. Törmä**, High speed memory from carbon nanotube field-effect transistors with high-k gate dielectric, *Nano Letters* 9, 643 (2009).

## Selected Recent Papers (2)

- V. Jokinen, L. Sainiemi, **S. Franssila**, Complex droplets on chemically modified silicon nanograss, *Advanced Materials* 20, 3453 (2008).
- R. H. A. Ras, M. Kemell, J. De Wit, M. Ritala, G. Ten Brinke, M. Leskelä, **O. Ikkala**, Hollow inorganic nanospheres and nanotubes with tunable wall thicknesses by atomic layer deposition on self-assembled polymeric templates, *Advanced Materials* 19, 102 (2007).
- Y. Jia, H. Jiang, M. Valkeapää, **H. Yamauchi, M. Karppinen, E.I. Kauppinen**, Oxygen ordering and mobility in YBaCo<sub>4</sub>O<sub>8.5</sub>, *Journal of the American Chemical Society* 131, 4880 (2009).
- R.H.A. Ras, E. Sahramo, J. Malm, J. Raula, **M. Karppinen**, Blocking the lateral film growth at the nanoscale in area-selective atomic layer deposition, *Journal of the American Chemical Society* 130, 11252 (2008).

# Members (1)

## Faculty of Information and Natural Sciences

- New and Renewable Energy Systems - *Prof. Peter Lund*
- Molecular Materials - *Prof. Olli Ikkala, Prof. Janne Ruokolainen*
- Optics and Photonics - *Prof. Matti Kaivola*
- Nanomaterials - *Prof. Esko Kauppinen*
- Quantum Dynamics - *Prof. Päivi Törmä*
- Nanomagnetism and Spintronics - *Prof. Sebastiaan van Dijken*
- Finite Element Research Group - *Prof. Rolf Stenberg*

# Members (2)

## Faculty of Chemistry and Materials Sciences

- Inorganic Chemistry - *Prof. Maarit Karppinen, Prof. Hisao Yamauchi*
- Physical Chemistry - *Prof. Kyösti Kontturi*
- Chemical Engineering - *Prof. Outi Krause*
- Polymer Technology - *Prof. Jukka Seppälä*
- Advanced and Functional Materials - *Prof. Simo-Pekka Hannula*
- Mechanical Processing and Recycling - *Prof. Kari Heiskanen*
- Metallurgy - *Prof. Lauri Holappa*
- *Micro- and nanofabrication* - *Prof. Sami Franssila*
- Wood Chemistry - *Prof. Tapani Vuorinen*
- Forest Products Surface Chemistry - *Prof. Janne Laine*
- Physical Characteristics of Surfaces and Interfaces – *Prof. Jari Koskinen*

# Members (3)

## Faculty of Electronics, Communications and Automation

- Nanotechnology - *Prof. Harri Lipsanen*
- Photonics - *Prof. Seppo Honkanen*
- Electron Physics - *Prof. Pekka Kuivalainen*
- Micro and Quantum Systems - *Prof. Ilkka Tittonen*
- TKK Micronova - *Director Veli-Matti Airaksinen*
- Control Engineering - *Prof. Heikki Koivo*
- Radiotechnology - *Prof. Sergei Tretyakov*
- Electronics Material Technology - *Prof. Mervi Paulasto-Kröckel*

# Members (4)

## Faculty of Engineering and Architecture

- Engineering Materials - *Prof. Hannu Hänninen*
- Building Materials - *Prof. Vesa Penttala*

## Separate Units

### Low Temperature Laboratory

- *Prof. Mikko Paalanen*
- *Prof. Jukka Pekola*



*The new **Nanomicroscopy Center** is one of the largest microscopy clusters in Europe and promises to be amongst the highest level facilities in the world.*

*The center is now housing various microscopes able to characterize hard materials down to atomic resolution, and soft materials including biomaterials down to molecular resolution.*



### **Three TEM's:**

Including: **JEOL 2200FS** double Cs corrected high resolution TEM and liquid helium cryo-TEM **JEOL 200FSC**

### **SEM's and AFM's**

- **JEOL JSM-7500F SEM**
- **Veeco Dimension 5000 AFM**
- **Veeco multimode AFM**
- **RHK UHV STM**

**Sample preparation for Hard-, soft- and biomaterials**

# MICRONOVA – Centre for Micro and Nanotechnology

**A Unique Platform for Joint R&D in Micro and Nanotechnology with the status of National Research Infrastructure**

**Partners:**

**VTT – Technical Research Centre of Finland**

**TKK – Helsinki University of Technology**

- Personnel altogether 360
  - *Of which 60 PhD students and 17 professors*
  - *Largest clean room facilities in Nordic countries*
  - *Industrial scale facilities: 2600 m<sup>2</sup> clean room, class 10-100*
- Collaboration with industry, companies and universities
- Eight companies located in Micronova



**Micronova is located in the Otaniemi Campus Area and was established in 2003**

[www.micronova.fi](http://www.micronova.fi)

# MICRONOVA

# Micro and Nanofabrication Development Program 2002-2008



Complete  
microfabrication line  
(2002-2004)



Molecular Beam  
Epitaxy for magnetic  
semiconductors,  
metals and  
insulators  
(2002-2003)



Electron Beam  
Lithography  
(2005)



Nanofabrication  
cluster – FIB  
(2007)

Advanced MOVPE reactors  
for III-V semiconductor  
deposition  
(2003)



Cryogenic Deep  
Reactive Ion Etching  
(2005)



Scanning Probe  
Microscope with bio-AFM  
capability (2006)



Atomic Layer  
Deposition  
(2006)

