# Myfab Annual Report 2012

Myfab - The Swedish Research Infrastructure for Micro and Nano Fabrication
www.myfab.se


myfab

## MYFAB SUMMARY

Myfab is the Swedish national research infrastructure for cleanroom-based microtechnology, nanoscience, and characterisation, funded by the Swedish Research Council, and the three participating universities[1]. Myfab is an integrated open-access infrastructure serving 630 active users and about 80 companies on an annual basis[2].

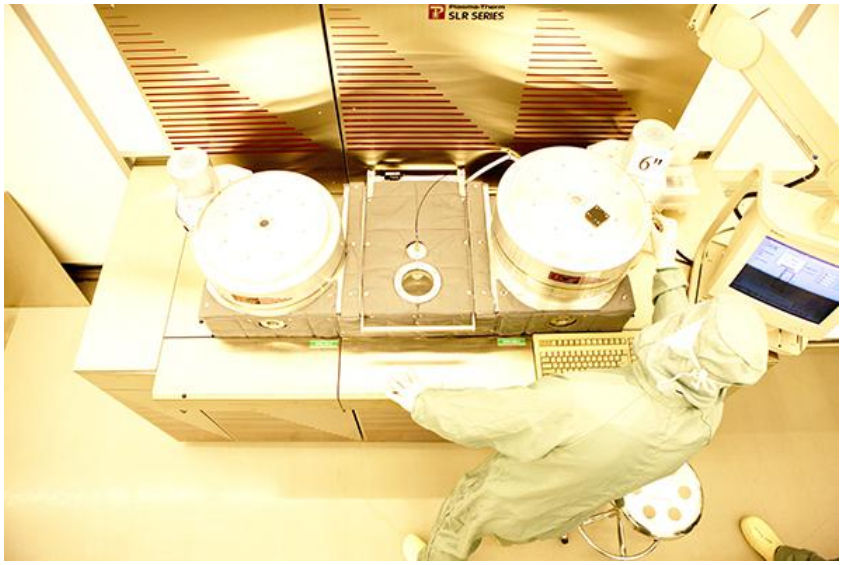
**Vision**

Myfab is the first choice, world-class infrastructure for micro- and nanoscale fabrication and characterization, enabling researchers and innovators to solve the grand challenges of the future.

**Mission**

Myfab provides cleanroom-based resources for microtechnology and nanoscience, supporting researchers and innovators in achieving world-class results and developing products for the needs of society.

Myfab's ambition is to offer the best available tools and support to its users in a timely manner. Since nanoscience and nanotechnology is one of the most important fields for research and development, and since the field develops very rapidly, it is of the utmost importance for the competitiveness of Swedish researchers and innovators that the development of Myfab continues.




1 *The three universities are Chalmers University of Technology in Gothenburg, KTH Royal Institute of Technology in Stockholm and Uppsala University. The university and external funding consists of base support from the universities and academic and external user fees.*

2 *From Myfab LIMS data for year 2012. Active users are users who perform activities themselves within the cleanrooms. Such users are typically part of user groups in the near environment of Myfab: in measurement laboratories or in companies, continuing the work by performing analyses, integration tasks etc.*

## Common values

1. **Sharing**
   We share common resources, knowledge and opportunities. We pass our knowledge on to others to enable continuous improvement.
2. **Supporting**
   We have an open and generous environment with a framework for supporting each other to constantly enhance our results.
3. **Taking responsibility**
   We take individual responsibility for everything we do and we act for quality.

## Mid-term evaluation 2012

Myfab was appointed to a national research infrastructure in 2010, funded by the Swedish Research Council (SRC), the participating universities and through user fees. The current financing period 2010 - 2014 is Myfab's third, and a mid-term evaluation of Myfab and ten other national research infrastructures was carried out during September 2012, commissioned by SRC.

The evaluation report released shortly before Christmas 2012 was very favourable for Myfab. Below are three citations made by the international scientific panel in the report, which clearly communicates that Myfab has evolved into a leading research infrastructure:

> *"MyFab has positioned itself as a European and world leader in micro/nanotechnologies, not only in scientific output, but also with regards to facility management."*
>
> *"The panel feels that the management arrangement at MyFab is very good, with a very capable and enthusiastic director at its helm. All important boards and committees are in place and functioning acceptably."*
>
> *"MyFab can serve as a model to other distributed infrastructures for micro/nanofabrication throughout Europe and as an example of a well-managed, national infrastructure for Sweden."*

## Myfab – the focal point of the nation's efforts[3]

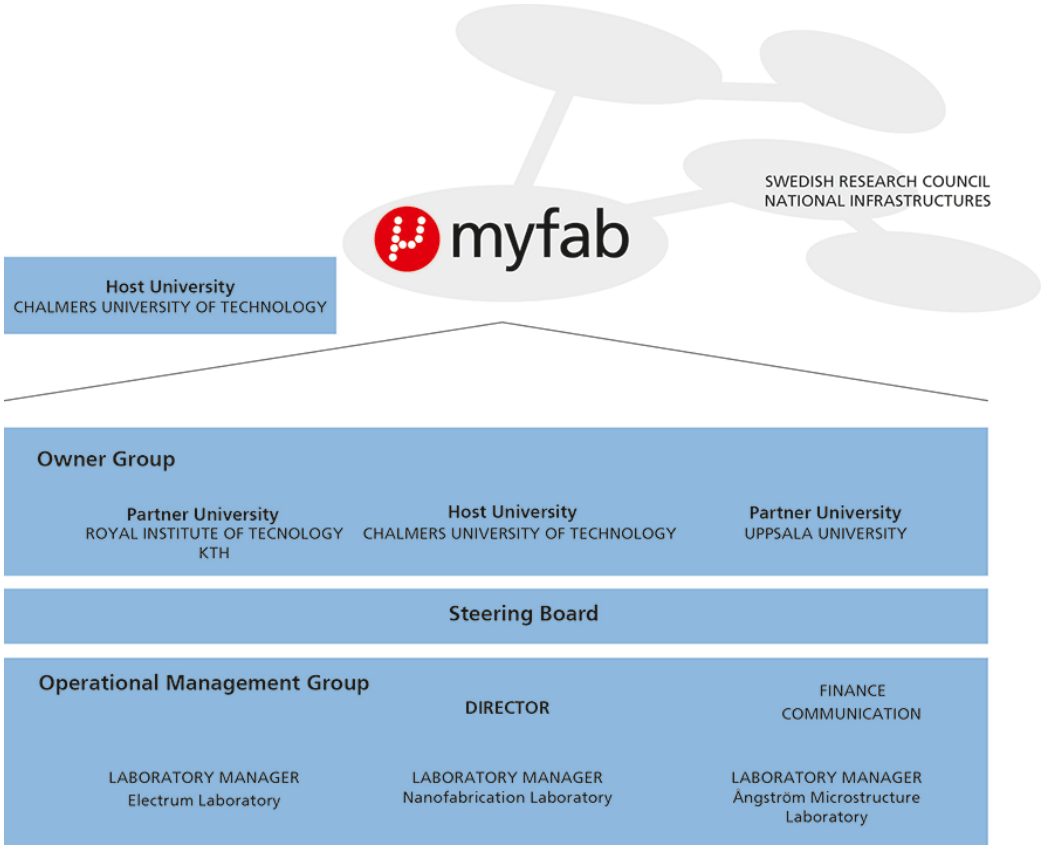
Being Sweden's national research infrastructure for microtechnology and nanoscience, Myfab attracts the vast majority of Sweden's nanotechnology researchers and entrepreneurs within its field, and in 2012 we recorded an all-time-high usage for the fifth year in a row.
Compared to the annual usage figures from 2008, the number of active users has increased from 493 to 630 (+27.7 %), and the number of booked tool-hours from 113149 to 137191 (+21.2 %).

Today, Myfab combines the resources and competences of three of the four large cleanroom-based nanotechnology laboratories in Sweden. Myfab applied to SRC for funding together with Lund Nano Lab (LNL) already in 2011 for inclusion of LNL in Myfab. Inclusion of LNL was also strongly advocated for by the evaluation panel, which stated in the evaluation report: "Expansion to Lund is an excellent opportunity and should be pursued to its fullest". This

[3] From the recommendation section of the evaluation report.

would, in addition to LNL's resources and competence, open possibilities for collaboration with MAX-Lab/MAX IV and ESS, which are located close to LNL. LNL are already using Myfab LIMS, and statistics assembled in the same way as for Myfab give 146 active users during 2012, an increase from 129 (+13.2%) in 2011.

## MANAGEMENT




### Myfab's steering group

Myfab's steering group was appointed by Chalmers University of Technology (Chalmers) for the period 2010-12-01 – 2012-12-31, and consists of eight members: Hans Hentzell, CEO Swedish ICT (chairman), Susanne Aalto (Assistant Prof. Radio Astronomy, Onsala Space Observatory, Chalmers), Gunilla Bökmark (CEO Sahlgrenska Science Park), Håkan Engqvist (Prof. Physics, Uppsala University), Ludvig Edman (Prof. Physics, Umeå University), Per-Erik Hellström (Docent Solid-State Electronics, KTH), Susanne Holmgren (Prof. Emerita Zoophysiology, University of Gothenburg), nominated by SRC, Nils Mårtensson (Prof. Physics, Uppsala University), nominated by SRC).

*Steering group meetings*

Myfab's steering group met four times during 2012, (numbering continues from 2011): meeting 5 in Uppsala on January 18, meeting 6 on April 26 at Onsala Space Observatory (including guided tour and presentation of this national research infrastructure), meeting 7 on September 11 in Gothenburg, and meeting 8 on November 13 in Stockholm.

### Operational management

Myfab's operation is managed by the Director Thomas Swahn in collaboration with the communication manager Christina Caesar, and the laboratory managers Peter Modh

(Chalmers), Stefan Nygren (Uppsala University) and Nils Nordell (KTH). Project managers and representatives from Myfab's owner group participate in some meetings, projects and workshops.

### Myfab's International Science and Technology Advisory Board

Myfab's International Science and Technology Advisory Board (ISTAB) was formed after a decision at Myfab's steering group meeting 7 and consists of three members: Prof. William Stanchina (University of Pittsburgh, PA, USA), Prof. Alain Cappy (IEMN, University Lille1/RENATEC, France), Dr. Berit Sundby Avset (SINTEF, Norway).

### Workshops for strategic planning

Myfab annually arranges 2 -3 workshops for strategic planning, usually with a specific topic in focus. Two such workshops have been held during 2012, one in April and one in October.

Myfab workshop 25 April 2012 in Gothenburg

Myfab's operations management carried out a one-day workshop in Gothenburg on April 25. The focus was on communication and preparation for the evaluation of Myfab.

Myfab workshop 29 – 30 October 2012 in Järfälla

Myfab's second workshop focused on Myfab's payment model, organisational improvements, the Myfab's User Meeting 2013 in collaboration with NorFab, and general updates within the organization. The meeting was held at Görväln in Järfälla on 29 – 30 October, and the participants were Myfab's Operations Management, Owner Group, and NorFab's Management (through telephone link during part of the meeting).

## APPLICATIONS TO STRENGTHEN MYFAB

Myfab has an operations grant from the Swedish Research Council, and together with user fees and support from the participating universities, this fuels the operations of Myfab. Myfab needs to renew and expand its equipment, to stay at the front edge. It is expected that the host universities cover investments in those tools which are considered fundamental for the cleanroom laboratories. Investments in expensive tools cannot be financed by the SRC operations grant, so Myfab therefore applies regularly for additional funding for this purpose. Such applications are based on Myfab's strategic investment plan.

### Inclusion of Lund Nano Lab, now recommended by the evaluation panel

Today, Myfab combines the resources and competences of three of the four large cleanroom-based nanotechnology laboratories in Sweden. Myfab applied to SRC for funding together with Lund Nano Lab (LNL) already in 2011 for inclusion of LNL in Myfab. This would, in addition to LNL's resources and competence, open possibilities for collaboration with MAX-Lab/MAX IV and ESS, which are located close to LNL. The application was put on hold by SRC.

### Funding for high-resolution electron beam lithography equipment granted by KAW

On 5 April 2012, Knut and Alice Wallenberg Foundation (KAW) awarded Chalmers a grant of 22 MSEK for investment in electron beam lithographic equipment at the Myfab Nanofabrication Laboratory (NFL) at MC2, Chalmers. This investment will strengthen the expert profile in high-resolution electron beam lithography at NFL.

### Application to SRC in April 2012 rejected

Myfab submitted an application to the Swedish Research Council during April 2012, for investment in some strategic tools for Myfab: CVD for Graphene and an XRD, a chemical polishing tool and an ion beam etch tool. Unfortunately, the application was rejected.

## MAJOR EVENTS DURING 2012

### Myfab positively evaluated

Together with ten other national infrastructures, Myfab was evaluated by three international expert panels, commissioned by the Swedish Research Council.

The overall aim was to evaluate the outcome and performance of each infrastructure in relation to the intentions in the call for funding and the agreed terms and conditions specific to that infrastructure. The outcome of the evaluation will be a basis for the Swedish Research Council's decision on further funding and measures for improvement of the infrastructures. Further, the evaluation should provide recommendations for improvement on management and activities at the infrastructures.

The outcome of the evaluation report was very positive for Myfab. We refer to the full report from the Swedish Research Council.

The members of the evaluation panel of Myfab, MAX-lab, PRACE and SuperAdam were: Odd Ivar Eriksen, the Research Council of Norway, Norway (Chair), Aaron Stein, Brookhaven National Laboratory, U.S.A., Doris Keitel-Schultz, DKSST Consulting, Germany, and Cherri Pancake, Oregon State University, U.S.A.

The evaluation comprised a self-evaluation, a user inquiry, and a hearing (18 September) held by the evaluation panel. Myfab's representatives at the hearing were Hans Hentzell (chairman of the Steering Committee), Dag Winkler (Host University and Owner Group representative), and Thomas Swahn, Director Myfab.

### VR RFI-2 visited Myfab at Chalmers on 13 March 2012

Five representatives (out of nine) of the Swedish Research Council's Evaluation Panel 2 (BG2): Infrastructure for molecular, cell and materials science, participated in a visit to Chalmers MC2 and the Nanofabrication laboratory: Stacey Sörensen, (Lund University, chairman), Dick Heinegård (Lund University, vice chairman), Tor Ny (Umeå University), Xiaodong Zou, (Stockholm University), and Lars Wärngård (VINNOVA). Tove Andersson and Johan Holmberg from the Research Council took part. Additional members of BG2: Björgvin Hjörvarsson (Uppsala University), Kajsa Uvdal (Linköping University), Ingrid Reineck, Sandvik and John Eriksson (Biocenter, Turku, Finland).

### KTH ISO 9001 audit as a basis for Myfab's quality control work

Det Norske Veritas (DNV) carried out an audit for certification of Electrum Laboratory according to the ISO9001:2008 standard in April 2012. The results of this audit form the basis for broader quality control work in Myfab. A work group is being created, where personnel from the three Myfab laboratories carry out a project to define a suitable scope for a quality system for Myfab and then implement the same.

### Myfab's annual report for 2011 delivered to the Swedish Research Council

On 15 April, Myfab delivered its annual report to SRC.

### The International Science Festival in Gothenburg 2012

The Nanofabrication Laboratory and MC2 as usual hosted the very popular 'Nanoscientist for

The International Science Festival in Gothenburg

a day' during the Science Festival. During the activity, one class of 11 year old schoolchildren visits the cleanroom each day for some hands on experiments.

### Future Friday

The tour of the Electrum Laboratory was a highly appreciated item at the annual Future Friday event at KTH School of ICT. Future Friday is intended primarily for students in grades two and three in high school and inspires to future studies within the field of information and communication technology. http://www.futurefriday.se/

### Myfab LIMS User Meeting

On November 20, the first Myfab LIMS User Meeting at Chalmers assembled about 15 representatives from cleanrooms using Myfab LIMS to discuss status and plan which new functionality we want to develop for the benefit of everyone.

## COMMUNICATION

The overall communication strategy is to strengthen the image of Myfab as an open, flexible, world-leading and reliable infrastructure for micro and nanofabrication. This will position Myfab as the first choice for nanofabrication in Sweden.

Myfab's most prioritized target group is researchers at all levels within the academic system, but also at high-tech companies, mainly start-ups, and companies that perform research.

Over the course of 2013, Myfab will become increasingly visible to a broader target group, especially toward new users in small and medium-sized companies and within academia, to funding agencies and the general public. To attract new users and small and mid-sized companies, *the Myfab Access program* (see below) was initiated. The program will lower the start-up financial barrier and stimulate the creation of new activities and relations.

During 2012, a draft for an extensive *Myfab brochure*, "This is Myfab", was produced. The brochure will be finalized during 2013. The brochure will be used to inform and attract new users as well as the public. The brochure aims to increase the understanding of nanotechnology and what nanotech can achieve in product development and growth opportunities for small and medium-sized companies. Success stories have been identified that originate from Myfab-related research and they will increase the understanding and possibilities of nanotechnology.

During 2012, Myfab continued with inviting researchers from universities around the country to visit our laboratories and gaining an understanding of what resources are available for them to use in Myfab.

*Myfab LIMS* – our common electronic interface - promotes use of the infrastructure with its open access and presentation of all resources.

The *Myfab User Meetings* (bi-annual) have become the largest national meeting place for nano-researchers. In 2013, the user meeting will be widened even more, and contacts to

interact with other organisations within the nano research community, such as SwedNanoTech and NorFab (Norwegian equivalent to Myfab) have been established.

## MYFAB ACCESS


Based on a decision at Myfab's 6th steering group meeting, 1.5 MSEK was allocated to a program of first-time free access for new users – Myfab Access. Myfab Access offers free access to the cleanroom facilities for a limited test or start-up project. The aim is to make potential new users aware of the resources available through Myfab, and the major opportunities that exist for companies to get assistance in developing innovations in their respective areas of operation.

The program was announced on 6 November with a first call for proposals, and a program selection panel with members from all of the three Myfab laboratories/universities will distribute the funding based on project quality and guidelines prioritising users from academia and SMEs who are expected to be returning users. The program manager for Myfab Access is Ulf Södervall, Chalmers (former project manager for FP6 MC2 Access), and the program selection panel consists of Niclas Roxhed (KTH), Nils Nordell (KTH), Greger Thornell (ÅSTC & chairman for MSL steering group), Stefan Nygren (UU), Göran Alestig (Chalmers) and Jan Stake (Chalmers).

## OUTREACH ACTIVITIES

Several outreach activities were carried out by Myfab's operational management during 2012; below are some of the most important.

### Electrum Laboratory board meeting 20 February

Myfabs Director presented Myfab's vision and strategy at the board meeting of the Electrum Laboratory in Kista on 20 February.

### NorFab collaboration - Trondheim visit 20 – 22 May

Myfab's operations management visited NorFab at NTNU to see their facility and discuss collaborations. During the meeting, Myfab and NorFab decided to co-arrange a user meeting during spring 2013.

**Oslo 25 May – Myfab LIMS for NorFab**

Peter Modh and Martin Klarkvist (Intiro) visited NorFab at the University of Oslo to support the setup of the Myfab LIMS environment for NorFab.

**Workshop: "Research Infrastructure for Industrial Innovations", 14 June Stockholm**

The Director presented Myfab at a national workshop (translated), "Research Infrastructure for Industrial Innovations", arranged by the Swedish Research Council, VINNOVA, Industrirådet, and RISE. The title of the presentation was (translated) "Myfab – an environment where research and industry meet". The workshop also included several discussion sessions in groups, with the aim being to find general conclusions and discuss best practices. The participants (around 60) typically represented decision makers from industry and research founders. Relative to other research infrastructures presented at the workshop, Myfab can offer very short access time or even instant access through its open access scheme. Currently, about 1 in 5 users come from industry, and about 80 companies use Myfab annually.

**Toulouse 25 – 26 October – TRAIN$^2$ workshop**

The Director Thomas Swahn was invited to present Myfab at the TRAIN$^2$ workshop in Toulouse on 25 – 26 October. The focus was on infrastructure networking, and the meeting had participants from around ten European countries. Invited presentations were also given by RENATECH from France, Tyndall Institute from Ireland, and IMTEK from Germany. Participants at the meeting decided to co-edit a white paper, formulating expected benefits from collaboration with structuring the European infrastructure landscape, and proposing calls for pan-European open access programs.

**Delft 21 November**

Myfabs Director participated together with NorFab in a meeting with NanoLab NL at Delft University on 21 November.

**Southampton 22 November**

Peter Modh, laboratory manager at Chalmers NFL, visited the University of Southampton on 22 November, to give a demonstration of Myfab LIMS.

**Myfab exhibitions 2012**

Myfab set up exhibitions and organized lab tours at several conferences and events during 2012; some examples:

- The Scandinavian Electronics Event in Stockholm on 17 – 19 April (S.E.E., http://www.bif-fairs.com/15261-s-e-e-scandinavian-electronics-event.html)

- SwedNanoTech's NanoForum 8 May in Stockholm
  http://swednanotech.com/kalendarium/nanoforum-2012/
- Micronano System Workshop 9 – 10 May in Linköping (MSW 2012)
  http://www.enterprise-europe-network.ec.europa.eu/public/calendar/viewdetails.cfm?EventID=3037&type=future
- AIMdays in both Uppsala and Lund on October 25

  http://aimday.se/blog/welcome-to-aimday-materials-2012/
- International SiC Power Electronics Applications Workshop, Kista 29 – 30 June,
  https://www.acreo.se/events/isicpeaw-2012
- IMAGIC seminar days, Kista 9 – 10 October,

  https://www.acreo.se/events/imagic-seminar-days-2012
- Interdiciplinary Biosensing Workshop, Kista 6 December
  https://www.acreo.se/events/bio-sensing-innovation-through-successful-partnering

## ATTEMPTS TO STRUCTURE NATIONAL EUROPEAN INFRASTRUCTURES

Recently, several discussions and activities have started with the aim of coordinating national nanotechnology research infrastructures within Europe. The idea, promoted by Myfab several times since an initial meeting in Paris in July 2009, is that through coordination, open access and suitable funding, pan-European collaboration and cross-fertilisation will emerge in a similar way but on a larger scale as compared with the concluded FP6 MC2 Access. During almost all of the visits and presentations described in the previous section, benefits of taking an initiative to structure European infrastructures were discussed.

### FP7 NANO-TECH Ecosystem Technology

In the FP7 NANO-TEC project, where Myfab participates and where Chalmers is responsible for arranging four workshops, it was decided that Myfab's Director and the Director of RENATECH (France) Alain Cappy should present the conclusions from the "Ecosystem" part of the project to representatives of the Capacities program. This is yet another proposal for structuring the European research infrastructures. In essence, the project recommends that each country is represented by its national research infrastructure (i.e. the project recommends countries to form such national research infrastructure networks if they do not already exist), and that Europe should not create a new organisation for this purpose, but rather this should be taken care of by one of the existing organisations.

### QNANO

Myfab, represented by Uppsala University, participates in this European Union-funded infrastructure for nanomaterial safety testing. The four year project began in February 2011 and comprises 27 top European experimental and analytical facilities in nanotechnology, medicine and natural sciences. It aims to create an integrated hub to support Europe´s nanosafety research community. Myfab-Ångström participates in joint research activities and provides transnational access to the lab resources.

**European Commission consultation on research infrastructures**

The European Commission invited to an open consultation on Research Infrastructures, topics for Integrating Activities, which was open 15 July – 22 October 2012. The aim is to provide a wider and more efficient access to, and use of, the research infrastructures existing in EU Member States, Associated Countries, and at international level when appropriate.

Myfab has submitted a proposal, which was coordinated with several other European national research infrastructures. For instance, in Norway NorFab submitted a proposal which focused on an identical approach, and partners in the TRAIN$^2$-project (including partners from RENATEC France and NANOLITO Spain) also submitted a proposal that was coordinated with Myfab's.

In the context of structuring European research infrastructures, Myfab LIMS was proposed by Myfab as an efficient tool, already used by four national research infrastructures, to operate and create reports from open research infrastructures.

The commission reported in December 2012 that it has received more than 550 proposals representing more than 250 topics. No individual feedback will be given, but a final report by high-level experts will be made available by the end of February 2013.

## MYFAB LIMS

The Norwegian equivalent to Myfab, NorFab, has been running Myfab LIMS since 1 July in its three university cleanrooms:

- NTNU NANOLAB at NTNU Trondheim,
- UiO MinaLab at University of Oslo
- HIVE MST-LAB at Vestfold University College
-

The fourth node at SINTEF in Oslo is operated in a different way, and Myfab LIMS needs some further development to include batch follower and queue systems before the SINTEF node can start using LIMS.

KTH Royal Institute of Technology has set up a Materials Laboratory, a virtual environment based on Myfab LIMS and a web portal based on the same platform as Myfab's. Here researchers can search and get information about all equipment in Electrum Lab, Greenhouse Labs and KTH Materials Lab.

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# SPECIFIC POINTS REQUESTED BY SRC IN THE ANNUAL REPORT

In the contract between the Swedish Research Council and Myfab, it is stated that Myfab should address the ten points listed below in the annual report.

## 1. Number of users, including new groups

Myfab introduced its in-house developed Myfab LIMS system by 1 January 2008 in all Myfab laboratories, and we passed our first 5-year milestone by the end of 2012.

Statistics from Myfab LIMS display 1094 users with access during 2012, 630 of which are active, i.e. have been using the infrastructure at least once during 2012. This is the highest number registered up to now. The corresponding numbers for 2011 are: 1040 total number/622 active users, in 2010 we registered 982 users/573 active users, in 2009 we had: 906 users in total/524 active users, and finally during 2008: 841 registered users/493 active users. The relative change since 2008 is that in 2012 the total number of users has increased by 253 or 30.0 %, and the corresponding increase for active users is +137 and +27.8 %.

| Full year | Number of users with access | Change relative to the previous year [number / %] | Accumulated change | Number of active users | Change relative to the previous year [number /%] | Accumulated change |
|---|---|---|---|---|---|---|
| 2012 | 1094 | +54 / +5.2 % | +253 / +30 % | 630 | +8 / +1.3 % | +137 / +27.8 % |
| 2011 | 1040 | +58 / +5.9 % | +199 / +23,7 % | 622 | +49 / +8,6 % | +129 / +26,2% |
| 2010 | 982 | +76 / +8.4 % | +141 / +16,8 % | 573 | +49 / +9,4 % | +80 / +16,3 % |
| 2009 | 906 | +65 / +7.7 % | +65 / 7,7 % | 524 | +31 / +6,3 % | +31 / +6.3 % |
| 2008 | 841 | No data available* | | 493 | | |

**Note Myfab LIMS has been used at all Myfab laboratories since 2007. Data from 2007 and earlier were not registered fully or registered using other methods, and are not suitable for comparison.*

If Myfab and Lund University receive a positive decision on our application from 2011 for the inclusion of Lund Nano Lab (LNL), an additional 146[4] active users at LNL (an increase from 129 or +13.2 % as compared with 2011) would result in a total of 776 active users. LNL is already using Myfab LIMS, a corresponding prising model so their statistics could be compared on equal terms with that of Myfab.

In Uppsala a new group from the biomedical disciplines and five small companies added new users during the year, whereas another recent start-up left the lab due to bankruptcy. ÅAC Microtec, a long-term multiple-user company, entered a rental agreement to install their own tools and processes. At Chalmers, two new academic user groups and one start-up company, all three from biomedical disciplines, started to use the cleanroom infrastructure. In Stockholm three new companies and six research groups (from KTH, Stockholm University and Karolinska Institue) were added to the user's list.

[4] We have checked so we do not double-count users which are active users in both Myfab and NLN.

## 2. Major changes of the organisation

Myfab has strengthened the communication organisation by assigning a communication manager: PhD Christina Caesar on 50% of a full-time position (starting at the end of August 2012).

## 3. Number of peer-reviewed articles related to the infrastructure

The number of peer-review articles by authors or projects using Myfab during 2012 is 627. The number is the result from a process where each publication is manually selected if the work reported is based on Myfab usage to a significant extent, using data lists from available databases at the participating universities, which are compulsory for the affiliated staff to keep updated. Currently, Myfab does not have a routine of its own to register publications, so the actual number of publications is likely to be higher than we report here. One outcome from the evaluation of Myfab was the recommendation to introduce a (compulsory) reporting process for Myfab users, and Myfab will evaluate the best possible implementation from both the user and the reporting perspectives during 2013.

## 4. Number of patents related to the infrastructure

Myfab has more than 600 active users who bring about project activities involving 1500 – 2000 persons or even more taking into account that each active Myfab user typically collaborates with 2 – 3 persons when outside the cleanroom laboratory. This extensive group of researchers and entrepreneurs is spread around a large number of research groups and companies. It is not mandatory for Myfab users to report patents emerging from the infrastructure, and neither is there a process through which patents or other IP rights are gathered. The reason for this is that Myfab does not track nor control the use of results among its users. The number of patents is therefore difficult to determine, and we are not prepared to answer the question in any other way than this. From a manual investigation some data is available: KTH reports three patents and six patent applications during 2012, and Chalmers reports three patent applications.

## 5. Economical account including other major contributions applied for or received

The total operations grant during 2012 from SRC was 31 000 000 SEK. Most of the funding was distributed to the three Myfab laboratories according to the established key number (so called X-funding): Chalmers 40%, KTH 30% and UU 30%. The corresponding amounts are: 9 164000 SEK 6 873 000 SEK and 6 873 000 SEK, total: 22 910 000 SEK. 1 500 000 SEK was distributed to the further development of the Myfab LIMS and Myfab's website, 2 990 000 SEK was distributed to Myfab's administrative account, 1 600 000 SEK to the Myfab Access project (100 000 SEK thereof for project management), and finally 2 000 000 SEK was equally distributed among the three laboratories to strengthen their organisations to better assist new users and users from new fields. These contributions (666 667 SEK per lab) were transferred to the 2013 budget since the recruiting process could not start during the few remaining weeks of 2012.

The sum of administrative costs 2012 is 3 277 974 SEK which includes remuneration to the steering board, salaries to the director and communication officer, consultant costs, advertising, information, printing costs, travel expenses, rent for premises etc. The balance of

Myfab's administrative account is positive, but decreased to 2 536 170 SEK by 31 December 2012 (2 824 144 SEK 2011-12-31).

The LIMS account has a negative balance: -202 226 SEK (187 977 SEK 2011-12-31); the reason for the negative balance is that the invoicing process of licence costs (from Norway, Finland and Ireland) was delayed. The amount corresponds to the negative balance and will be reported as an income to the LIMS account during 2013.

Below we present separately the budgets for Myfab's laboratories:

**Chalmers Nanofabrication laboratory, 2012**

| **Income** | **SEK** |
|---|---|
| Faculty grants | 20 589 200 |
| Chalmers foundation | 6 000 000 |
| Myfab | 9 930 666 |
| External customers | 4 003 055 |
| User fees Chalmers | 2 225 537 |
| User fees MC2 | 14 712 170 |
| Finances deprec. | 17 000 000 |
| **Income, total** | **74 460 628** |

| **Costs** | **SEK** |
|---|---|
| Personnel | 15 796 326 |
| Rent premises | 18 269 166 |
| Depreciation | 7 905 129 |
| Equipment and service | 5 204 450 |
| Consumption | 5 730 180 |
| Overhead | 4 555 377 |
| Finances deprec. | 17 000 000 |
| **Costs, total** | **74 460 628** |

**KTH Electrum Laboratory, 2012:**

| **Income** | **SEK** |
|---|---|
| Faculty grants | 13 200 000 |
| User fees, University | 18 600 000 |
| U. fees comp. incl. Acreo | 16 200 000 |
| Myfab | 7 539 667 |
| Services etc. | 1 500 000 |
| KAW grants | 4 400 000 |
| To 2013-budget | -666 667 |
| **Income, total** | **60 773 000** |

| **Costs** | **SEK** |
|---|---|
| Personnel | 15 700 000 |
| Rent premises | 11 700 000 |
| Operation | 18 800 000 |
| Overhead | 3 973 000 |
| KAW depreciation | 4 400 000 |
| | |
| Depreciation | 6 200 000 |
| **Costs, total** | **60 773 000** |

**Uppsala Ångström Microstructure Laboratory**[5]**,** 2012:

| **Income** | **SEK** |
|---|---|
| Faculty grants | 12 043 000 |
| Myfab | 7 539 667 |
| User fees, remun. | 10 521 000 |
| KAW grants | 3 665 000 |
| To 2013-budget | -666 667 |
| **Income, total** | **33 102 000** |

| **Costs** | **SEK** |
|---|---|
| Personnel | 8 433 000 |
| Rent premises | 11 458 000 |
| Operation | 6 440 000 |
| Overhead | 2 774 000 |
| Depreciation | 4 165 000 |
| **Costs, total** | **33 270 000** |

[5] *In the compilation for Ångström Microstructure Laboratory, the budget for Ion Technology Center (ITC) is not included.*

The Myfab Access account holds 1 600 000 SEK because the projects had not yet started their activities by the end of 2012. The Myfab Access funding will finally be distributed to the Myfab laboratories to cover processing costs and project management. The total turnover of the three Myfab laboratories was 168 335 628 SEK, in which 25 010 000 SEK from Myfab's operations grant (of a total of 31 000 000 SEK) is included. Myfab's operation grant is 18.4 % of the laboratories' total revenues, and its contribution directly to laboratory operation is 14.9 %.

## 6. International contacts and collaborations

National collaboration on the Myfab level is particularly strong with Lund Nano Lab (LNL). For more than three years, LNL has been operating in a way very similar to Myfab, e.g. by using Myfab LIMS for tool booking. Also, other Swedish and European laboratories use Myfab LIMS in their operation.

Myfab is a founding member of SwedNanoTech, the umbrella organisation for Swedish nanotechnology actors with the goal of increasing the knowledge of nanotechnology in a broad sense.

In the European arena, Myfab is strengthening the bilateral collaboration with other national research infrastructure networks. The collaboration with the Norwegian NorFab is well developed, with common meetings and a suggested co-arrangement of the Myfab User Meeting in 2013. Collaborations with the French RENATEC, NanoLab NL in the Netherlands, and Spanish NANOLITO networks have been initiated and visits have been made to their sites. A focus for Myfab is to influence the call structure of the European Union, and hence Myfab is participating as the Swedish node in the "Small institutes group", together with partners from Finland, Norway, Ireland, the Netherlands, Belgium, UK, Greece and Spain. Myfab also follows the development in the EIN2 initiative for new calls. In addition, the Myfab nodes are members in the SiNANO institute and participate in the technology platforms of Photonics 21 and ENIAC, and are also members in a number of EU funded infrastructure related projects, e.g., FP7 Nano Connect Scandinavia and NANO-TEC (Chalmers), QNano (Uppsala University) and Technet_nano (KTH). Through KTH, Myfab participates in the cleanroom platform collaborative network since 1997, where representatives from eight European laboratories meet twice annually.

## 7. To what extent the scientific goals have been achieved, or new revised goals

Myfab is a research infrastructure which provides access to a large number of tools for fabrication and characterisation, expertise on process flows and individual tools, as well as on a wide range of applications. Myfab does not produce scientific results itself; its mission is to support users from academia and industry to achieve their goals. Myfab's goals are therefore managerial and technical rather than scientific.

As already mentioned above (section Major events during 2012), Myfab and 10 other national research infrastructures were evaluated (a mid-term evaluation arranged by SRC), where a large number of aspects of being a research infrastructure were evaluated. We refer to the evaluation report from SRC: "Interim Evaluation of 11 national research infrastructures – 2012 44" for a complete description, but we can conclude that Myfab so far indeed has achieved its goals and fulfils its mission. Citing the final report from the evaluation: *"The panel*

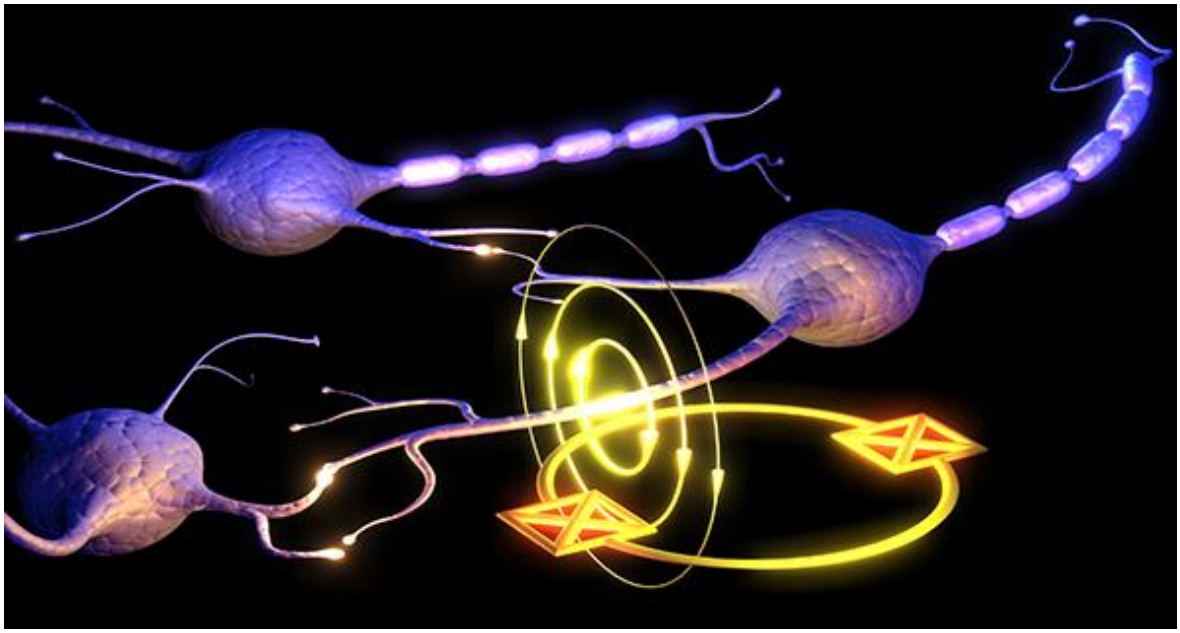
*concludes that MyFab certainly fulfils the expectations of the grant, including the terms and conditions for research infrastructure."* , and, even more positive: *"MyFab can serve as a model to other distributed infrastructures for micro/nanofabrication throughout Europe and as an example of a well-managed, national infrastructure for Sweden."*

## 8. Major scientific breakthroughs

The examples listed below have in all cases used Myfab facilities to some extent

Advanced brain investigations can become better and cheaper

An important method for brain research and diagnosis is magnetoencephalography (MEG). But the MEG systems are so expensive that not all EU countries have one today. A group of researchers at Chalmers University of Technology are now showing that MEG can be performed with technology that is significantly cheaper than that which is used today – technology that can furthermore provide new knowledge about the brain.



Communication between brain cells generates magnetic fields that can be measured with SQUID sensors. Focal MEG puts the sensors closer to the head, thereby improving signal levels and enhancing focus on brain activity
Illustration: Philip Krantz, Krantz Nanoart

Quantum microphone captures extremely weak sound

Scientists from Chalmers University of Technology have demonstrated a new kind of detector for sound at the level of quietness of quantum mechanics. The result offers prospects of a new class of quantum hybrid circuits that mix acoustic elements with electrical ones, and may help illuminate new phenomena of quantum physics.

Graphene mixer can speed up future electronics

Researchers at Chalmers University of Technology have for the first time demonstrated a novel subharmonic graphene FET mixer at microwave frequencies. The mixer provides new opportunities in future electronics, as it enables compact circuit technology, potential to reach high frequencies and integration with silicon technology.

Rapid laser for harsh environments

Researchers at Chalmers University of Technology have reached a data rate of 40 Gbit / s at a temperature of 85 º C through on-going development of their already world-leading technology for fast data communication lasers. This is a breakthrough in the quest for fast lasers for optical communication links in harsh environments such as data centres and supercomputers, where temperatures can reach high levels, while large amounts of data must be transferred between routers, servers, switches, processors and memories.

Nanoelectronics with spin

Spintronic research at Chalmers University of Technology utilises spin function of electrons in semiconductors and two-dimensional electronic materials. The researchers have shown that the electrical current and thermal gradient create large spin polarisation of silicon and spin transport in the graph, at room temperature. The purpose of this research is to integrate both memory and logic operations using the electron spin degree of freedom in a single nano-device.

Monolithic Microwave Integrated Circuit with world record performance

Scientists at Chalmers University of Technology have successfully processed InP wafers in monolithic microwave integrated circuit (MMIC) process containing among others K/Ka 3-stage amplifiers intended for cryogenically cooled extremely low noise amplifiers. The amplifiers were designed, manufactured and delivered under contract to the European Space Agency/European Space Operational Centre in Darmstadt, Germany for use in ground stations for deep space communication, e.g. ESTRACK Malargüe, Argentina. The performance of the amplifiers is on the level of world record results for these frequencies.

New transistor for millimetre-wave power applications up to 100 GHz

Chalmers' research on devices and integrated circuits based on wide band-gap semiconductors (WBG) is targeting the need for power generation at high frequencies. We have developed fabrication and characterisation methods to evaluate such electronics for application in mobile communication infrastructure and sensor application. This year we have demonstrated an InAlN/AlN/GaN transistor, with a maximum frequency of oscillation above 200 GHz, which enables the design of circuits above 100 GHz. This transistor was fabricated in Nanofabrication Laboratory at Chalmers and has a nominal minimum line width of 50 nm.

World record in low noise amplifiers for microwave

Researchers at Chalmers University of Technology have made a new world record in low-noise performance of a microwave amplifier, as low as 0.002 dB. These amplifiers with low noise are of great interest for equipment requiring high sensitivity and gain, e.g. in physics and astronomy.

Preparation of graphene

Researchers at Chalmers University of Technology have shown a promising technique for free transferable transparent electrode production. The graphene is a scalable and uniform material, with the ability to control the thickness. It can be put on virtually any non-metallic substrates that stand out at 1000 °C makes it a material with many possibilities. Graphene deposited directly onto quartz and sapphire shows transmittance and conductivity similar to

exfoliated or metalcatalysed-graphene. The model proposed is a non-catalytic CVD mechanism in which a high methane concentration, a long deposition time, a high temperature and smooth substrate are required to grow a large area of the graphene by means of carbon/hydrogenpyrolysis.

Space probes will be more useful with amplifiers from Chalmers

Researchers at Chalmers University of Technology have developed a new generation of amplifiers, which the European Space Agency (ESA) will be using throughout the world to receive signals from its space probes and satellites. ESA will be able to use the new amplifiers to measure data that is currently buried by noise.

The space probe Mars Express with the aim of searching for water at the surface of Mars and launch a robot on its surface. Image courtesy of ESA.

SiC integrated circuits operating at 500 C

Silicon carbide (SiC) has been investigated for high voltage devices over the past 20 years at KTH (spun off in TranSiC AB and later acquired by Fairchild Semiconductor). Recently, high temperature operation has been demonstrated, first at 300°C and now at 500°C. Researchers at KTH Royal Institute of Technology have developed a unique in-house process technology for bipolar mixed signal silicon carbide integrated circuits, and the first batch has been successfully tested at 500°C. The KTH research was also assessed in the RAE 2012: "The unit clearly has internationally leading expertise in the area of SiC based devices and circuits. It is arguably the strongest academic unit in the world." Applications for high temperature electronics can be found in many areas including nuclear energy, geothermal energy, and oil and gas drilling. The project continues with SSF funding under the motto: “to boldly go where no electronics has gone before”.

Novel Graphene Hot Electron Transistors in KTH

Researchers at KTH Royal Institute of Technology have demonstrated the first Graphene Base Hot Electron Transistor (GBT). This novel device exploits both the ultra-thinness and high conductivity of graphene to deliver superior DC and RF performance. Unlike the conventional

graphene field effect transistors, the carriers transport perpendicular to the graphene plane showing high ON/OFF ratio. Considering the compatibility of the fabrication scheme with state-of-the-art silicon technology, GBT is promising for future RF and digital electronics.

High Performance Sensors based on Graphene Technology

Researchers at KTH Royal Institute of Technology are developing next generation sensing devices. These devices combine graphene's extraordinary electrical and mechanical properties to make high sensitivity pressure sensors. They also combine the advantages of state-of-the-art performance with a smaller size than conventional sensors.

Highly scaled thulium silicate interfacial layer for high-k/metal gate CMOS technology

Advanced CMOS technology is the enabling technology for the information and communication society. Scaling the interfacial layer between the Si channel and the high-k oxide in transistors without increasing leakage current and maintaining high mobility is key for future CMOS technologies. Researchers at KTH Royal Institute of Technology have developed a thulium silicate (TmSiO) process based on atomic layer deposition that enables an extremely scaled equivalent interfacial layer thickness less than 0.3 nm with low leakage current and high mobility

High density silicon nanowire-based sensors

The silicon nanowire is a promising nanostructure for biochemical sensors. For future silicon nanowire-based sensors, it is mandatory to integrate a vast amount of silicon nanowires with CMOS technology. At KTH Royal Institute of Technology, a cluster tool has been upgraded to allow both reactive ion etching and plasma enhanced deposition without breaking vacuum. Using the cluster tool researchers have advanced KTH's Sidewall Transfer Lithography process and demonstrated individually addressable nanowires with a density $>10^5$ $cm^{-2}$ by the integration of nanowires into KTH's CMOS process.

SiGeSn epitaxy for nanoelectronics and nanophotonics

The SiGeSn material system is attractive since band engineering can tailor the material properties to enhance the performance of transistors, detectors and light emitters. At KTH Royal Institute of Technology, researchers have developed a Sn source and implemented it in a chemical vapour deposition tool to enable epitaxial deposition of SiGeSn on Si wafers. High quality SiGeSn layers with high Sn content of 6 % has been demonstrated.

Artists perspective on nanotechnology

The Albanova Nanofabrication Laboratory sponsored and worked with the VR funded project "NanoFormGiving", which brings an artist's perspective to nanotechnology. See http://www.nanoform.se

Epiclarus – a III-V spin-off

Epiclarus, a spin-off company from KTH Royal Institute of Technology, is based on more than two decades of experience from active research in III-V materials and devices. It provides epitaxial solutions for components requiring very thick layers of InP and GaAs on planar or non-planar substrates or structures, using Hydride Vapor Phase Epitaxy. Epiclarus has in less than a year established a stable customer base and estimates a turn-around at 1.5 MSEK for 2013.

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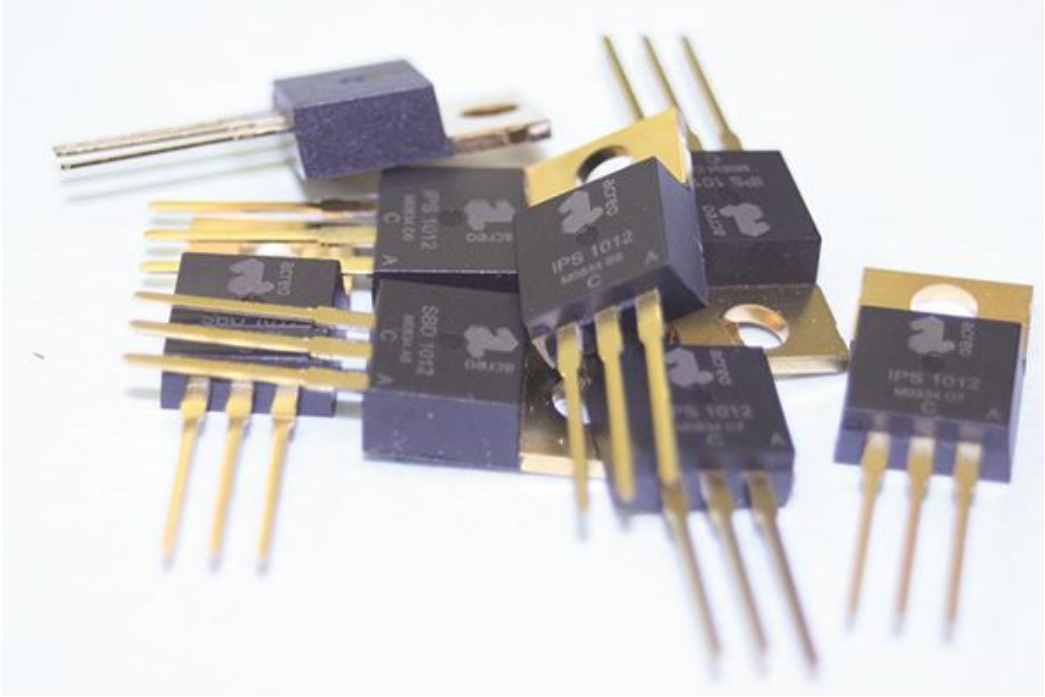
Intermodulation Products – an Atomic Force Microscope start-up

The Nanostructure Physics group at KTH Royal Institute of Technology has launched a start-up company, Intermodulation Products AB, which is making and marketing signal processing hardware and software for advanced surface analysis with the Atomic Force Microscope. They have recently published a breakthrough method based on this technology in the journal Nature Communications [DOI: 10.1038/ncomms2365].

World's smallest optical disk resonator

KTH has built the world's smallest optical disk resonator, which will be able to increase the




bandwidth and significantly reduce the power consumption at large data centers used by, e.g., Google and Facebook. The resonator acts as a filter which may be used in light modulators and detectors. The breakthrough is a step towards photonics integrated circuits, with dimensions approaching transistor ditto, and will eventually replace electronic connections with more efficient optical ones.

Liquid alloy printing of microfluidic stretchable electronics

Integrated circuits of elastic electronics is set to enable exciting new form factors for electronic devices that are not possible with conventional rigid or flexible electronics. However, just as with traditional electronics, these ICs must be complemented with large-area stretchable PWBs and components. A breakthrough demonstration at the Ångström Laboratory MST program is the

microfluidic stretchable printed intelligence formed by liquid alloy structures that have been printed and embedded in elastomers with integrated electronic components.

Ultra-sensitive magnetic probes flying from the International Space Station

One of the ultra-sensitive magnetoresistive magnetometers developed by the MST program and Ångström Space Technology Centre has now been tested in a pico-satellite sent out from the International Space Station.

Miniaturized sampler allows for sub-glacial and volcanic aquifer microbial sampling

Within the MST program and Ångström Space Technology Centre research project on advanced miniaturized submersable explorers a unique miniaturized sampler has been developed. Combining acoustic trapping and high pressure valving that allows for sub-glacial and volcanic aquifer microbial sampling at high depths.

A graphene capacitor for field-effect ion sensing

The unique electronic properties of graphene were exploited for field-effect sensing in both capacitor and transistor modes when operating the sensor device in electrolyte. The device was fabricated by researchers at Uppsala University, using large-area graphene thin films prepared by means of layer-by-layer stacking. Although essentially the same device, its operation in the capacitor mode was found to yield more information than in the transistor mode. The capacitor sensor could simultaneously detect the variations of surface potential and electrical-double-layer capacitance at the graphene/electrolyte interface when altering the ion concentration. The capacitor-mode operation further facilitated studies of the molecular binding-adsorption kinetics by monitoring the capacitance transient.

Solution-processed logic gates based on nanotube/polymer composite

Researchers at the Ångström Laboratory have demonstrated hysteresis-free logic gates capable of operation at 100 kHz. The devices were based on local-gate thin-film transistors with their channel featuring solution-processed composite films of single-walled carbon nanotubes and semiconducting polymer F8T2. Using dip-coating for deposition of composite films, the circuit fabrication process was simple and robust. The fabricated transistors that constituted the basic building block for the logic gates were characterized by nil hysteresis, high carrier mobility, large on/off current ratio, low operation voltage, small subthreshold swing, and remarkable scalability.

Unique processes for contact metallization for nano-CMOS technology

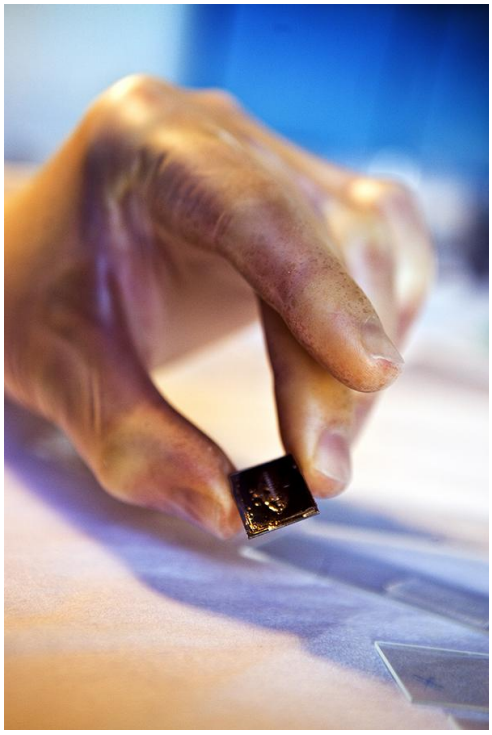
Nano-scale CMOS devices have become 3-D in structure and their fabrication requires a decreasing thermal budget. By exploiting the Ångström Laboratory expertise in contact metallization using metal silicides and high-power impulse magnetron sputtering (HiPIMS) for metal deposition, we achieved conformal and stable formation of ultrathin nickel-silicide films over 3-D structures relevant to the most advanced tri-gate transistor architecture. Our unique access to the advanced microwave annealing technique allowed us to realize low-temperature nickel-germanosilicide formation on epitaxially grown SiGe layers. Because of the low-temperature processing, the nickel-silicide films formed were low-resistive and uniform in thickness, both are crucial for high-performance nanoelectronics.

Negative electron mobility in diamond

Researchers at Uppsala University have discovered negative differential electron mobility in diamond. This is the first time this phenomenon is observed in an elemental semiconductor material

and may lead to new electronic devices, such as Gunn diodes in diamond for microwave applications.

High efficiency thin film solar cells



During 2012, CIGS-based solar cells with 18.6 % efficiency using a CdS buffer layer and 18.2 % using a ZnSnO buffer layer have been fabricated at the Ångström Laboratory (both values externally confirmed). Several concepts for improvements have been identified, and back contacts will be in focus for the coming period. In the area of CZTS-based solar cells, using sputtering and post-annealing, efficiencies have increased from 4.7 % to 7.5% in 2012. Theoretical calculations show a way of avoiding loss of tin during CZTS processing. This has been verified experimentally.

Aggregated proteins involved in Alzheimer's disease visualized for the first time

Researchers at the Ångström Laboratory have in a collaboration with Uppsala University Hospital and the Swedish company BioArctic Neuroscience used AFM and Raman spectroscopy to demonstrate aggregated oligomeric states of the proteins amyloid-beta and alpha-synuclein, both strongly involved in the neurodegeneration process of the brain. Understanding these aggregation processes are believed to be essential for future development of novel drugs and therapies.

Multidisciplinary research centre praised for making heavy use of the Myfab equipment

Uppsala Berzelii Technology Centre for Neurodiagnostics, a 10-year initiative from VINNOVA and the Swedish Research Council, has now reached half time and was evaluated by international reviewers in 2012. These experts were in particular impressed by how the Centre has been able to connect medical doctors, biologists, engineers and physicists to jointly attack difficult questions related to neurodegeneration. They also encouraged the many projects involving staff and equipment at Myfab-Ångström, e.g. to fabricate metalized nanowires from DNA threads in an attempt to develop a supersensitive protein detection method.

New distant galaxies to be explored with novel diamond micro-optics

Scientists at Université de Liége in Belgium have together with researchers at the Ångström Laboratory developed a novel solution for exploring exoplanets in remote galaxies. The device, which now is being tested at the European Southern Observatory in Chile, is based on a mid-infrared achromatic half-wave plate with diamond subwavelength gratings. The diamond microfabrication was carried out using laserbeam lithography and plasma dry etching.

A gold nano-wire based electrical sensor using rolling circle amplification

Researchers at Uppsala University have demonstrated a novel electrical sensor concept that uses rolling circle amplification (RCA) of DNA to bridge a 5 µm gap between two electrodes. Stretched RCA products are metalized to form metal wires that reduce the resistance from TOhm to Ohms. Combining RCA with electrical detection produces a highly specific and sensitive detection technique and unlike other sensors that are available on the market the readout for this sensor

should not be the limiting factor for the biomarker assay, since there is virtually no background noise to interfere with the readout.

## 9. The infrastructure's significance to direct societal interests

Myfab's premises are all openly available to a broad range of users from academia and industry. Students from the master programs can have access to the cleanrooms during their undergraduate studies and diploma projects, under the supervision of their supervisors and with the assistance of the cleanroom staff. This opportunity to gain relevant training in a real cleanroom environment is rather rare in the rest of the world, where the requirement typically is that you have started as a PhD student or have similar experience.

Myfab actively informs the public of the possibilities which micro and nanotechnology gives society in a popular form. Outreach activities include about 2500 visitors annually to Myfab cleanrooms. In particular, the guided tours to the cleanroom for students and the public during the Gothenburg Science festival and Futrure Friday event at KTH in Kista are very popular. The guided tours to the cleanroom at are probably the activities which are the most fully booked of them all at both these events..

The educational aspect is important for society. Students and researchers educated in micro/nanotechnology within Myfab, who later proceed to private enterprises or public organisations, constitute efficient communicators of knowledge during many years. These persons are also important for Myfab's network of experts and are competent procurers of projects etc.

## 10. The infrastructure's significance to trade, industry and other commercial interests

Myfab was established to provide a research infrastructure that would help researchers to solve the grand challenges of the world today – climate change, energy supply, aging population, diseases etc. Technology on the micro and nano scale is very important in today's electronics, automotive industry, cosmetics, hygiene, clothes, household products, food, sports and toys. Myfab is a supplier of competence needed to increase the competitiveness for Swedish industry, create jobs, improve healthcare and by making better use of the world's resources. Research in these areas is fundamental also to provide state-of-the-art education, attract the best students and so on.

About 30 spin-off companies have been created from research activities within Myfab during the last five years. Spin-off companies from Myfab have a turnover of more than 500 MSEK. Myfab has served about 120 companies during the last 5-year period with cleanroom access, process service etc. Several of these companies have special agreements and rent cleanroom space and install their own equipment in the cleanrooms. Myfab supports a scientific approach to understand and avoid possible safety risks related to nanotechnology.

It is of central importance for Swedish industry to have access to highly educated staff within the growing field of nanotechnology. Such an education must be experimentally hardware-oriented and here, Myfab's flexibility suits the purpose very well.

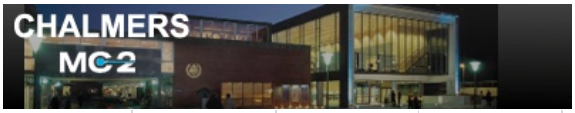
## ANNEX

A. Key numbers from Myfab LIMS for 2012

B. Publication lists from UU MSL, Chalmers MC2 NFL and KTH Electrum Lab

# Annex A – Myfab LIMS statistics 2012

Statistics from Myfab's LIMS system has been accumulated in the same manner at Myfab's three cleanroom laboratories since 1 January 2008. The table below has been used as Myfab's standard LIMS table for five full years now.






# Myfab Report

**Related**

Statistics for booked time
Statistics for logged time
Booked time list
Logged time list
Man hours
Bookings without logs
MyFab report
Cleanroom entrys

**Favorites** [edit]

All bookings
All tools
Booking overview
Fares and Charges
Invoice by project
Invoice by user
Laboratory / Group list
Licences by tool
Licences by user
My licenced tools
My profile
MyFab report
Newsletter
Process line list
Project list
Project members by project
Statistics for booked time
System settings
Tool down time
Tool list
Tool status
University / Company list
User list

- Re 1:29 ent page

**You are logged in as:**
**--modh--**

Logout

Optional filters for this list *(Hide filters...)*

Predefined time: 2012 Year: 2012
Custom time: to:

| | Statistics for 2012 | | | | Historic values for MyFab | | | |
|---|---|---|---|---|---|---|---|---|
| | Electrum | MSL | NFL | MyFab | 2011 | 2010 | 2009 | 2008 |
| **Number of:** | | | | | | | | |
| Users with access: | 385 | 340 | 369 | **1094** | *1040* | *982* | *906* | *841* |
| Active users: | 207 | 214 | 209 | **630** | *622* | *573* | *524* | *493* |
| Female active users: | 42 | 65 | 39 | **146** | *145* | *127* | *108* | *108* |
| Gender balance, active users: | 20% | 30% | 19% | **23%** | *23%* | *22%* | *21%* | *22%* |
| **Number of active users from:** | | | | | | | | |
| Universities: | 155 | 178 | 192 | **525** | *512* | *455* | *409* | *389* |
| Institutes: | 23 | 0 | 3 | **26** | *33* | *35* | *38* | *33* |
| Commersial: | 29 | 36 | 14 | **79** | *77* | *83* | *77* | *71* |
| **Number of companies with own personnel:** | 14 | 18 | 12 | **44** | *43* | *38* | *32* | *32* |
| **Number of booked hours:** | 42611 | 29304 | 65276 | **137191** | *134528* | *126070* | *116616* | *113149* |
| **Booked hours from:** | | | | | | | | |
| Universities: | 21551 | 27138 | 63650 | **112338** | *110513* | *103706* | *90306* | *88802* |
| Institutes: | 17064 | 0 | 282 | **17346** | *16546* | *16054* | *16700* | *14245* |
| Commersial: | 3996 | 2166 | 1346 | **7506** | *7470* | *6310* | *9609* | *10102* |
| **Number of tools:** | 230 | 191 | 194 | **615** | *579* | *505* | *474* | *434* |
| **Booked tools:** | 109 | 78 | 143 | **330** | *328* | *291* | *285* | *276* |

# Annex B – Myfab Publications 2012

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