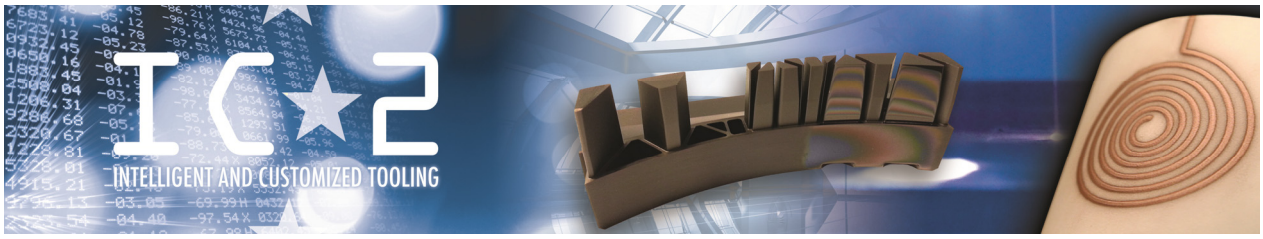
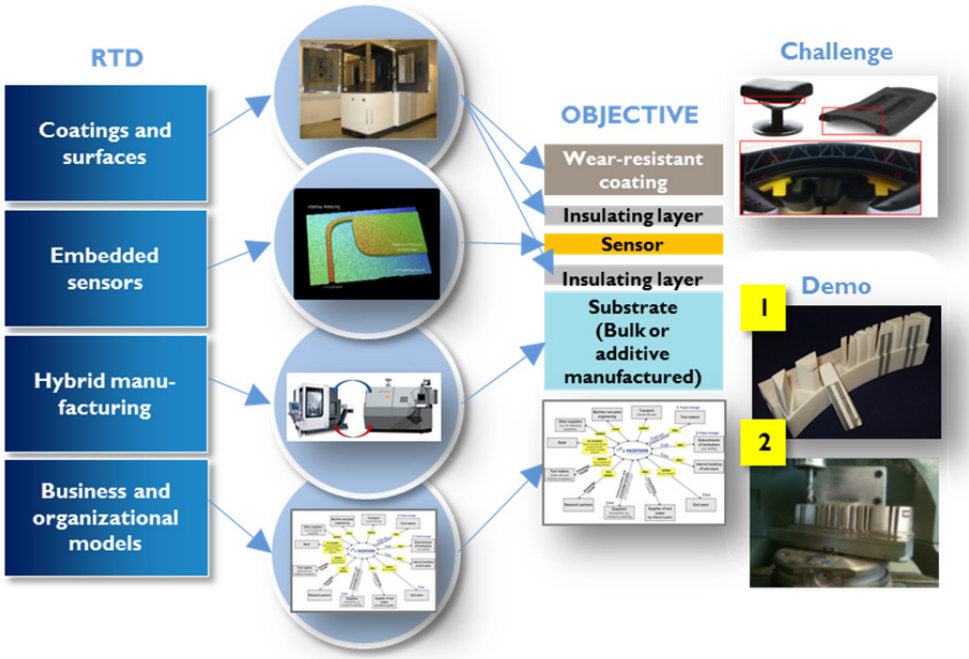


Open industrial conference

IC2 – Intelligent and Customized Tooling

17th September 2013



The industrial conference will present results from a large EU project funded by the European Commission (NMP-2009-4.0-5) focusing on INNOVATIVE AND KNOWLEDGE-BASED TOOLING INDUSTRY with contributions also from representatives from the industry.

Host	SINTEF and MiNaLab, Oslo
Location	Forskningsparken (**Address: Gaustadalléen 21**)
Time	9:30-16:00
Registration	Sign in by email to Line S. Holien, SINTEF at line.holien@sintef.no or phone +47 959 15 645. More information will be sent to you after registration.
Deadline	Friday 06.09.2012 at the latest

IC★2
INTELLIGENT AND CUSTOMIZED TOOLING

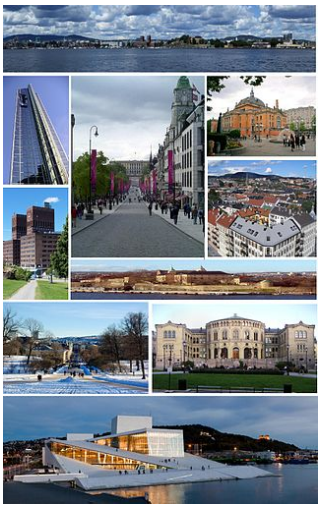
New production methods and organizational models enabling competitive injection moulding in Europe!

A pre-request for competitive injection molding in Europe is the ability to produce new and better performing injection molding tools as well as shortening the time from concept to products. The industrial conference presents a **tooling concept based on CNC machining combined with additive manufacturing**. The tools are protected with **new coatings** with **embedded sensors** providing on-line monitoring. The value chain is structured through new **organizational and business models**.

Date: Tuesday 17. September 2013 from 9:30 to 16:00

Where: Forskningsparken, Gaustadalléen 21

Hosted by: SINTEF Materials and chemistry and MiNaLab, Oslo



Aim:

The industrial conference present results from a EU project funded by the European Commission (NMP-2009-4.0-5) focusing on INNOVATIVE AND KNOWLEDGE-BASED TOOLING INDUSTRY.

The project Intelligent and Customized tooling, in short IC2, address the tool cost and the time-to-customers as well as quality, performance and higher value added tools utilizing a combination of: (i) hybrid manufacturing, (ii) surface embedded sensors, (iii) wear resistant coatings with friction control and, iv) novel organizational and business models. IC2 is focused on injection molding tools, where research and technology developments are made into real demonstrators.

A clear success of the FP7 project, IC2, is to bring demonstrators into real applications meeting industrial demands. During this open conference ***results from the project will be presented****. In addition, a couple of* ***relevant and inspiring presentations*** *will be given by invited external speakers, and hopefully the conference can also be an arena for* ***new project ideas and relations.***

Programme - Tuesday, 17th September 2013:

09:30 Registration, coffee and networking

10:00–10:20 An introduction to the EU project IC2 - *Intelligent and Customized tooling*

Lars Tore Gellein, Coordinator of IC2, SINTEF Raufoss Manufacturing AS, Norway

A broad overview of the IC2 project is presented as an introduction to the subsequent, more focused presentations given by other representatives from the consortium. The introduction will focus on the main idea behind the project, some lessons-learned and a brief summary of the main results from the project.

Lars Tore Gellein, Research Director, MSc from the Norwegian University of Science and Technology in Trondheim, Institute of Engineering Cybernetics. He worked for Kongsberg Automotive AS (traineeship, production engineer and R&D-manager) for some years, before he started working as a researcher at SINTEF in 2008. He presently works as Research Director for the Production Technology department at SINTEF Raufoss Manufacturing AS.

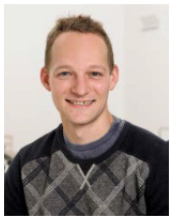
10:20–10:40 Industrial demonstrators - an instrumentality to shift R&D results into real business processes.

Dr. Martin Geiger, Cirp, Germany

The main reason for companies to participate in R&D projects is to excel in the competition by gaining the advantage of new and innovative technologies as and exploiting them by economical methods. Therefore, it is important to test and validate the R&D results by application to real-life business situations. The principal tools for these validations are industrial demonstrators located at the industrial partners' plants. The presentation will show how these industrial demonstrators have been used for the evaluation of IC2 research topics and the future exploitation of the results in the daily business of the industrial partners.

Martin Geiger is working as a consultant in Rapid Product Development (RPD) as a freelancer. Starting in 1991, he worked 6 years as senior researcher in the field of RPD at Fraunhofer IPA and 4 years at DaimlerChrysler AG. In 2001, he created his own company Coachulting and coordinates industrial knowledge networks and consults companies in knowledge management and process optimization in RPD. Furthermore, he is R&D coordinator at cirp in a side job.

10:40–11:00 Embedded thin-film temperature sensors on tool parts with tailored protective coatings



Dr. Bjarke Holl Christensen, Danish Technological Institute

Today various types of bulk sensors are applied in injection molding tools to have valuable feedback for optimization or quality control. However, in some cases these sensors cannot be fitted into the optimal position in the mold, or even not at all. In the IC2 project, a thin film sensor is developed which is deposited on the surface of the tool circumventing some of the challenges. The thin-film sensors consist of a multitude of layers, all with specific requirements, but with an accumulated thickness about 30 µm (3/100 mm). For the sensor to work, it must be electrically isolated from the underlying tool part which is done with a wear-resistant, electrically insulating alumina coating. On top of this a platinum sensor is applied which again can be embedded with an insulating layer and a wear-protective coating with the desired release properties towards the polymer. All of this must be made in a robust way enabling the use in an industrial environment.

Bjarke Holl Christensen, finalized in 2008 his PhD in physics from the University of Aarhus. Since then he has been employed at the Tribology Centre at Danish Technological Institute, where he has been working as a specialist on coating development for various applications.

11:00–11:15 Coffee break

11:15–11:35 DWTS sensors for temperature measurements

Dr. Tech Helena Ronkainen, VTT Technical Research Centre of Finland, Finland

Direct Write Thermal Spray (DWTS) technique can be used for fabricating sensors directly on 3D surfaces. DWTS is based on thermal spraying, which is a spray process where materials are accelerated in molten form and impinged onto the surface providing dense and strongly adhered deposits of materials that are able to endure high temperatures and harsh environments. In IC2 project DWTS technology was used to fabricate embedded temperature sensors on the surface of the injection moulding tool. The sensors consisted of ceramic dielectric layers and the thermocouple element in between. The integrated thermocouples were successfully used for temperature measurement on the knowledge intensive moulding tool proto developed in IC2 project. The measurements on different locations of the tool surface showed the temperature variation during injection moulding process cycles. The measured temperature data can be utilized e.g. for process modelling and optimization.

Helena Ronkainen, Principal Reseach Scientist at VTT, Dr. Tech. in Material Science in Helsinki University of Technology. She has over 20 years experience in tribology, material science and sensor development for tribological applications. She has been managing international and national research projects and contract research on tribology (friction, wear and lubrication), surface coatings, operational reliability and sensor development related issues.

11:35–11:55 Thin film coatings for plastic moulding tools

Sanna Tervakangas, DIARC-Technology Oy, Finland

DIARC-Technology Oy, one of the SME companies within the IC2 consortium, is an expert in coating technology. Their products are amorphous diamond, metal and ceramic thin film coatings which are manufactured with DIARC FCAPAD coating method. DIARC has developed and produced novel smart surface solutions within the IC2 project. These coatings are now commercially available to enhance the competitiveness of the customers by improving the performance of their products and services.

Sanna Tervakangas, Research Manager, M. Sc. in Physical Chemistry has 15 years' experience in material science, tribological testing and coating development. She has been a project manager in several research and application development projects.

11:55–12:25 Hybrid Manufacturing – combining subtractive and additive manufacturing techniques

Vegard Brøtan, Dept. Production and Quality Engineering, NTNU, Norway

Dr. Klas Boivie, SINTEF Raufoss Manufacturing AS, Norway

State-of-the-art additive manufacturing (AM) of metallic materials enables production of industrial grade tooling with conformal cooling which can bring significant reductions in process cycle times. However, the production of tool inserts by AM is not a rapid process and the cost is usually higher than for conventionally produced inserts. A combination of AM with CNC milling in a hybrid process route makes it possible to use each manufacturing principle to produce the geometries and features it is best suited for. However, the combination of fundamentally different process principles, with fundamentally different process requirements, makes hybrid manufacturing a very complex process alternative. IC2 has developed an integrated solution to hybrid manufacturing where a metallic powder bed AM machine is combined with a conventional 5-axis CNC milling machine and control software to form a hybrid manufacturing cell.

Vegard Brøtan, PhD candidate at Department of Production and Quality Engineering, NTNU. Will finalize his PhD project on the topic "Additive manufacturing for high value metal production in an optimized hybrid manufacturing cell" in 2014. Has his MSc from NTNU in Production Systems.

Klas Boivie, has a M.Sc. in materials' science and received a Doctorate in additive manufacturing technology at The Royal Institute of Technology (KTH) in Stockholm 2004. After two years as a Post-Doc at the Norwegian University of Science and Technology, he is presently employed as a Senior Researcher at SINTEF Raufoss Manufacturing AS in Trondheim, Norway.

12:25–13:10 Lunch

13:10-13:20 IC2 demonstrator: Practical challenges in advanced injection moulding.

Lars Stenerud, Plasto AS, Norway

Plasto, as one of the SMEs in IC2, will give examples of typical challenges that they are facing in advanced plastic molding. The main focus will be on the challenges related to a product that was chosen for the Knowledge Intensive Tooling demonstrator. The case is related to a product that features several thin, critical sections which are molded by deep crevices in the tool inserts.

Lars Stenerud is Managing Director and one of the owners of Plasto AS, a leading Norwegian plastic moulding company. In addition he holds several key positions related to Norwegian manufacturing and education, such as chairman of the Board of SFI Norman - an eight year research program, board member of The Faculty of Engineering Science and Technology at The Norwegian University of Science and Technology (NTNU), as well as Norwegian representative in the Manufuture High Level Group. He has his master degree from NTNU.

13:20–13:40 IC2 demonstrator: Knowledge Intensive Tooling

Dr. Klas Boivie, SINTEF Raufoss Manufacturing AS, Norway

The Knowledge Intensive Tooling demonstrator addresses the challenges of the industrial case from Plasto by practical exploitation of IC2 research results. Sensors and coatings have been used to achieve real-time process monitoring that makes it possible to bring a new level of knowledge into the design of an advanced tool insert. This insert has been produced in the hybrid manufacturing cell and tested in full scale production at Plasto's facilities in Åndalsnes.

Klas Boivie: see above.

13:40–14:00 From business opportunities to business models – impact of new technologies on the collaboration network of the tooling industry

Stephan Schüle, Fraunhofer IAO – Institute for Industrial Engineering, Germany

New technologies like hybrid manufacturing, surface embedded sensors or wear-resistant coatings will enable new business opportunities for toolmakers and their suppliers, but also change the way of collaboration. Research institutes and industry partners of the IC2 project jointly developed a methodology for the determination of a company's business model and elaborated the changes in the collaboration network of toolmakers due to above mentioned, new technological solutions developed in the IC2 project.

Stephan Schüle graduated in mechanical engineering from the University of Stuttgart. He is employed at the Fraunhofer Institute for Industrial Engineering (Fraunhofer IAO). Presently, he works on different research and consulting projects in the area of innovation and technology management.

14:00–14:15 A small speech from the Project Officer: Feedback and new opportunities

Neophytos Neophytou, Project Officer for IC2, European Commission

The achievements of IC2 and briefly on future opportunities for collaboration.

Neophytos is working as a Research Programme Officer in the Directorate General for Research & Innovation, European Commission. He has a Bachelor in Mechanical Engineering and a Master in Business Administration. He is the Project Officer for IC2 and his portfolio includes 20 FP7 funded projects. He is the contact person for the European Technology Platform MANUFUTURE.

14:15–14:30 New opportunities: Horizon 2020 and national funding schemes

Tor Einar Johansen or Till Christopher Lech*, National Contact Point (NCP), Norwegian Research Council*

January 2014 is the formal start of the new EU framework program for research and innovation. The name is Horizon 2020, and if the European Commission gets it like they want, the budget will increase significantly compared to the Seventh Framework Programme for Research and Technological Development (FP7). A NCP from the Norwegian Research Council will give a brief introduction to Horizon 2020, and also include some information about national funding schemes.

Tor Einar Johansen, Norwegian Research Council.

14:30–14:45 Open discussion: feedback to the IC2-project, new project ideas etc.

Lars Tore Gellein, moderator.

14:45-15:00 **Two examples of hybrid manufacturing based on injection moulding**

Erik Andreassen, SINTEF Materials and Chemistry, Norway

Hybrid technologies have their challenges and SINTEF is involved in several research projects in this field. The first example is an insert moulding process for integrating a functional silicon chip (e.g. a sensor or a pump) in an injection moulded (polymer) lab-on-a-chip. The clue is to achieve robust leak-proof connections between fluid channels in the silicon chip and in the polymer part. The second example is the DuoCombe process where a part made by additive manufacturing is used as an insert, and the aim is to combine the best of additive manufacturing and injection moulding in a single product, especially for small to medium production volumes. This is a project lead by the Norwegian injection moulding company OM BE Plast.

Erik Andreassen is senior scientist at SINTEF Materials and Chemistry in Oslo. He performs applied research in the field of polymer-based materials, with processing (e.g. injection moulding), mechanical performance and novel applications as specialities. Andreassen is also adjunct professor at Vestfold University College, Institute for Micro- and Nanosystems Technology.

15:00–15:15 MiNaLab – brief presentation

Fabrice Lapique, Research Director MiNaLab

The services offered by the department of Microsystems and Nanotechnology of SINTEF ICT include feasibility studies, device design, prototyping, process development, and small and medium scale production in the MiNaLab cleanroom laboratory. MiNaLab is the only independent complete silicon processing line in Norway.

Fabrice Lapique, Research Director MiNaLab.

15:15–16:00 Guided tour at MiNaLab

The IC2 consortium:

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(2) Plasto AS Lars Støbakk Stenerud, lars@plasto.no Åndalsnes, Norway	
(3) Raufoss Offshore Erik Eidskard Morka, erik.morka@raufossoffshore.com Raufoss, Norway	
(4) Baldur Coatings AS Ola Nilsen, ola.nilsen@baldur.no Oslo, Norway	
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(10) Recon A/S Leif Jørgensen, lj@recon.dk Sonderborg, Denmark	
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