

Conference Report

**NNT'09 (The 8th International Conference on Nanoimprint and Nanoprint Technology):
November 11-13, 2009 - San Jose, California, USA**

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General Summary

Global Trends

A wide variety of diverse applications is presented, yet some trends can be extracted.

The difficult competition of Nanoimprint Lithography with Extreme UV optical lithography to be the next generation structuring technology in silicon based integrated circuit fabrication is emphasised in the plenary session. The drastic title of the plenary talk of **F. Pease** reads "*NNT is Losing the Propaganda War*". Therefore, production issues as defects and their inspection (most vividly presented by **D. Resnick** of *Molecular Imprints*) as well as overlay (alignment) issues are prominently addressed. Directly linked to this are industrial aspects of size and throughput which lead to large area and Roll-to-Roll-manufacturing. Examples include the patterning of a 24" TFT display presented by **Jinook Kim** of **LG** and the invited talk of **J. Guo (University of Michigan)** on "*Continuous Roll-to-Roll and Roll-to-Plate Nanoimprinting*". In summary the high resolution of the order of 10 nm (**S. Chou**) and the high throughput and large area capabilities (10 m long tapes and approx half meter widths of substrates) are regarded as the unique selling points of NNT.

Another major topic is the manufacturing of photonics structures like quantum dots and photonic crystals, photovoltaics-patterns, along with new aspects of surface enhanced Raman scattering enabled by high resolution large area structuring through NNT.

Finally the imprinting of large and small features at the same time is repeatedly dealt with. Two excellent presentations on the simulation of the imprinting process by **D. Mendels (Cognoscens)** and **H. Taylor (MIT)** have to be mentioned in this context. They both reduce the time needed for simulations of imprinting complex patterns by 1-2 orders of magnitude making optimisation cycles including simulation feasible.

The program can indeed be downloaded at: http://www.nntconf.org/pages/nnt_09/

The Conference:

Generally, a bibliography presented in the beginning shows that the field is very attractive as the number of papers is still in the phase of exponential increase amounting to over 3000 in 2008. More than 3000 patents and more than 100 Sociétés active in NNT show the technological potential of nanoprinting and imprinting, whereas the world wide market is estimated to \$300 M in 2008.

The conference's attendance of an estimated 200 people giving 40 talks and presenting 75 posters is very evenly balanced between Asia, Europe, and America.

The Exhibition

The exhibition is dominated by tool-making and related topics represented by **NILT, IMS chips, NNT AT, Shin Etsu, Hitachi** presented a unique method for sheet imprinting using belt-like imprint tools. A micro-contact printing machine was presented by **GESIM**. Imprinting resists were presented by micro resist technology and e-beam equipment by **Raith**.

In the exhibition and also in the rest of the conference the European FP7 project *NAPA-NIL* had been presented very effectively.

Highlights:

J. Rogers (University of Illinois) presents molecular resolution in soft nano-imprint lithography and single step 3D nano-manufacturing using an elastomeric phase-mask. Tens of nm resolution, restriction to 2D, and complexity are shortcomings of the otherwise perfectly well performing structuring tools of today's micro-electronic industries, which can be overcome by nano-imprinting.

"*The Nano-Imprinting Process towards Patterned Media Manufacturing*" by **T.W. Wu (Hitachi)** shows how nano-imprint lithography is added in a disk

production line to achieve the benchmark of Tbits/in² storage density.

A. Knoll (IBM Zurich) demonstrates how a heated probe is used to fabricate complex three-dimensionally textured substrates, which is regarded as a cost-effective and competitive alternative to e-beam lithography in tool-making, particularly when applied on non-conducting substrates.

Relevance to PolyNet and OLAE:

The NoE **PolyNet** is explicitly mentioned and results of the RC Nanoimprint Lithography presented in an invited talk "*Nanoimprint Lithography for Organic Thin Film Transistors*" by **Barbara Stadlober** of **Joanneum Research**. OLAE is presented by 2 talks, i.e. Barbara Stadlober's plus "*Micro contact printing of TFTs on A4 sheets*" by **H. Fujita** of **Dai Nippon Printing** and 3 posters, two of which are presented by **Herbert Gold** of Joanneum Research with the PolyNet logo on display and one by **P. Moonen** of **MESA +**.