Using new approaches for computer and communication systems hardware product authentication

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Abstract:

Product authentication is needed in anti-counterfeiting to distinguish genuine products from counterfeit ones. In spite of the current availability of sophisticated techniques and solution concepts for product authentication, secure authentication of different kinds of physical products remains an unsolved problem in practice. In this paper were present new approaches of anti-counterfeiting technique that include chemical, laser (laser induced forward transfer of materials) and nanoimprint approaches to insure the genuine of computers and communication systems parts. Our goal is to transfer trace elements, micro-, and nano structures as a fingerprint of product authentication. These techniques have high security of information or of materials which are deposited in a specified location known only by producer and end users. The results are used to ensure efficient authentication, with both high security and nominal cost. The deposited authentication patterns are not accessible or readable by naked eye. Further advantage, reproduction is a cumbersome process.

Authentication is the act of confirming the truth of an attribute of a datum or entity. This may involve confirming the identity of a person or software program, tracing t he origins of an artifact, or ensuring that a product is what its packaging and labeling claims to be.

It often involves verifying the validity of at least one form of identification . In another word, it is the process of determining whether someone or something is, in fact, who or what it is declared to b e.

Accordingly, it is the act to exclude counterfeting. Counterfeit goods range in quality, with some which are simle to spot. However, many counterfeit goods at first glance look the same as the original to an untrained eye.

This can be an issue for a co mpany’s supply, consumer, causing untold damage to a company’s brand and re putation.

There are many of fake goods entering into legitimate channels to market with counterfeit medi cines supplied in good faith, substandard spares fitted to cars with deadly consequences, and expectedly with sofisticated computers and communications hardware threatining nationals security and economy. .

In order to combat the problem of telling the difference between a real or fake product various technologies have been develo ped to make the task of product authentication more easy.

Main proposed approaches for authentication:

1- Laser Induced Forward Transfer of Materials:

Extensive research effort is currently carried out aimed at patterning approaches for obtaining controlled defined micrometric polymeric structures for several applications, including,

jewellery. electronics, optoelectronics, sensors, medicine etc, and

authentication by us for the first time to the best of our knowledge.

Lasers have been identified as appropri ate tools for processing of different materials, such as ceramics and metals, but also for soft, easily damageable materials (biological compounds and polymers).

In this work we study the dynamics of laser induced forward transfer (LIFT) with small separat ion between the donor and the receiver substrates, which is the basis for possible applications that require direct writing with high spatial resolution.

We succeeded in transferring micro and nanostructures gold, silver, etc to substrates which can candidates for computers and communication systems hardware.

The transfer process of nano -sized particles using the laser induced forward transfer of materials from the donor material to the acceptor material which can be a hardware for computers or communication system is shown in fig.1.

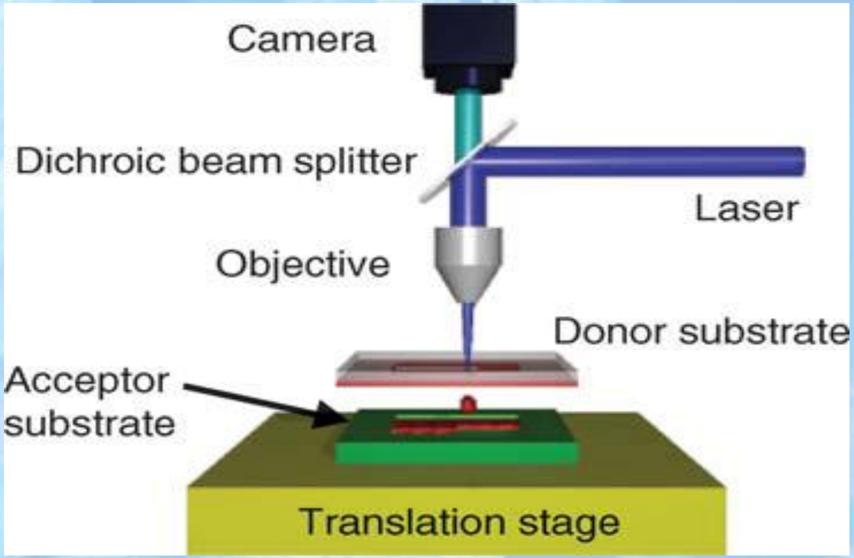


Fig.1: Shows the transfer process of nano -sized particles using the laser induced for ward transfer of materials from the donner material to the acceptor material which can be a hardware for computers or communication system. From Ref.Craig B. Arnold, Pere Serra, and Alberto Piqué , MRS BULLETIN • VOLUME 32 • JANUARY 2007 • www.mrs.org/bulletin.

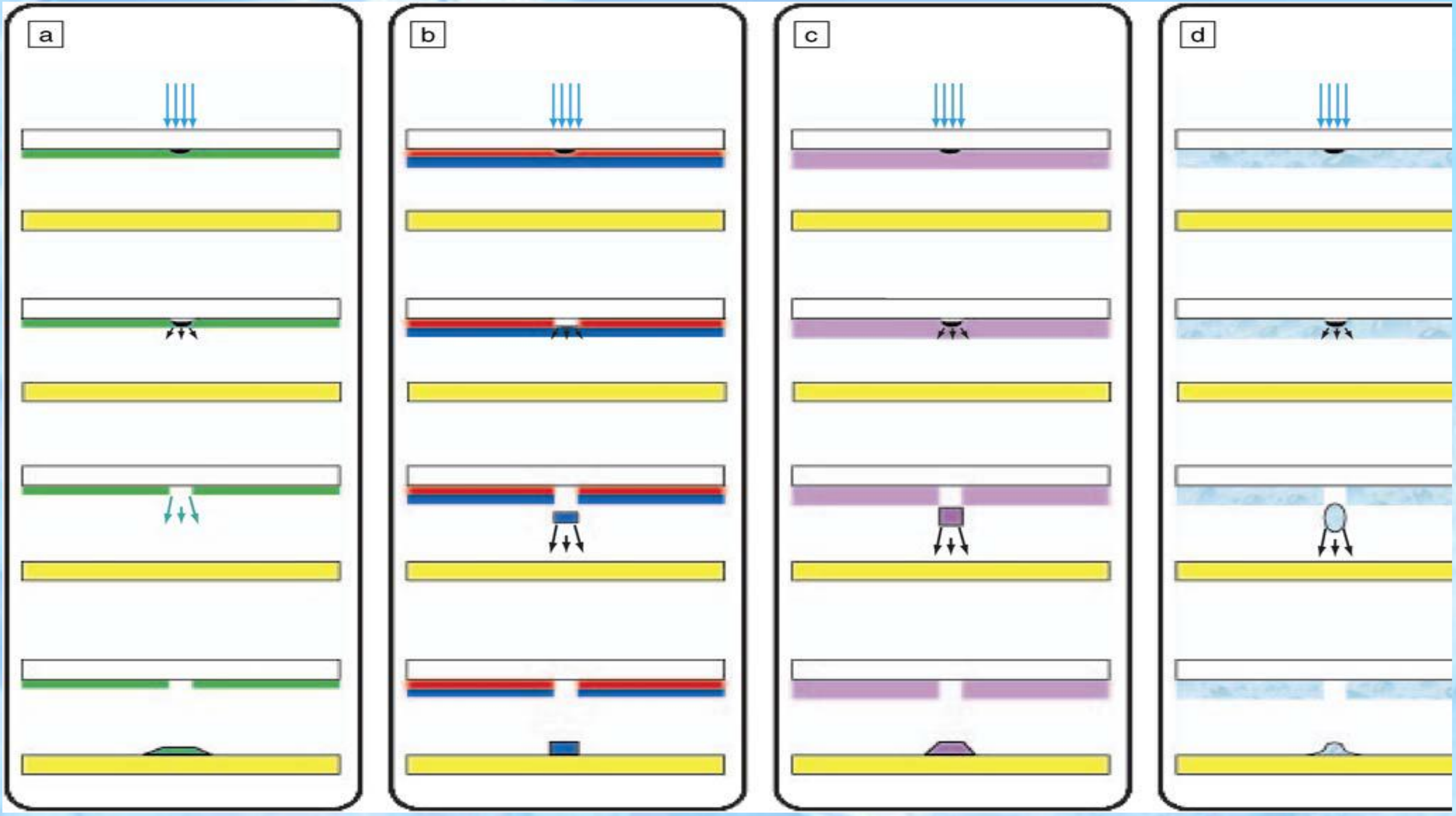


Fig.2 Shows the transfer mechanism for laser writing on materials. From Ref. Craig B. Arnold, Pere Serra, and Alberto Piqué, MRS BULLETIN • VOLUME 32 • JANUARY 2007 • www.mrs.org/bulletin

Here, the following processes take place:

1- Laser radiation evaporate the thin foil which is situated undeneeth the laser spot.

2- The laser radiation evaporates and pushes the film or foil forward (The blue color).

3- The laser radiation is absorbed by a sacrificial matrix (not shown).

The laser radiation is absorbed by a thin layer of the receiving substrate. It is possible to control the shape and nature of the deposited material.

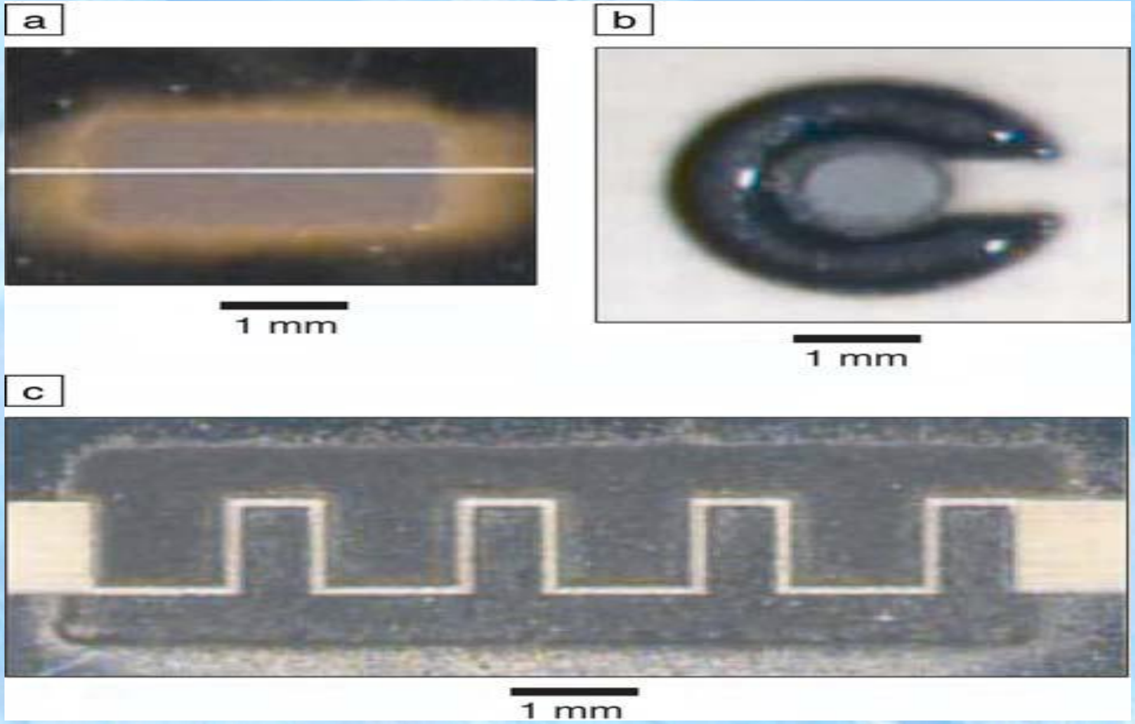


Fig.3 Examples of micro devices produced using the LIFT technique of direct writing.

- **a- Electrodes of a micro capacitor isolated with a 20 micron gap.**
- **b- Micro battery. The central part is made of Zink.**
- **c- Alkaline battery, the upper part is made of silver oxide.**

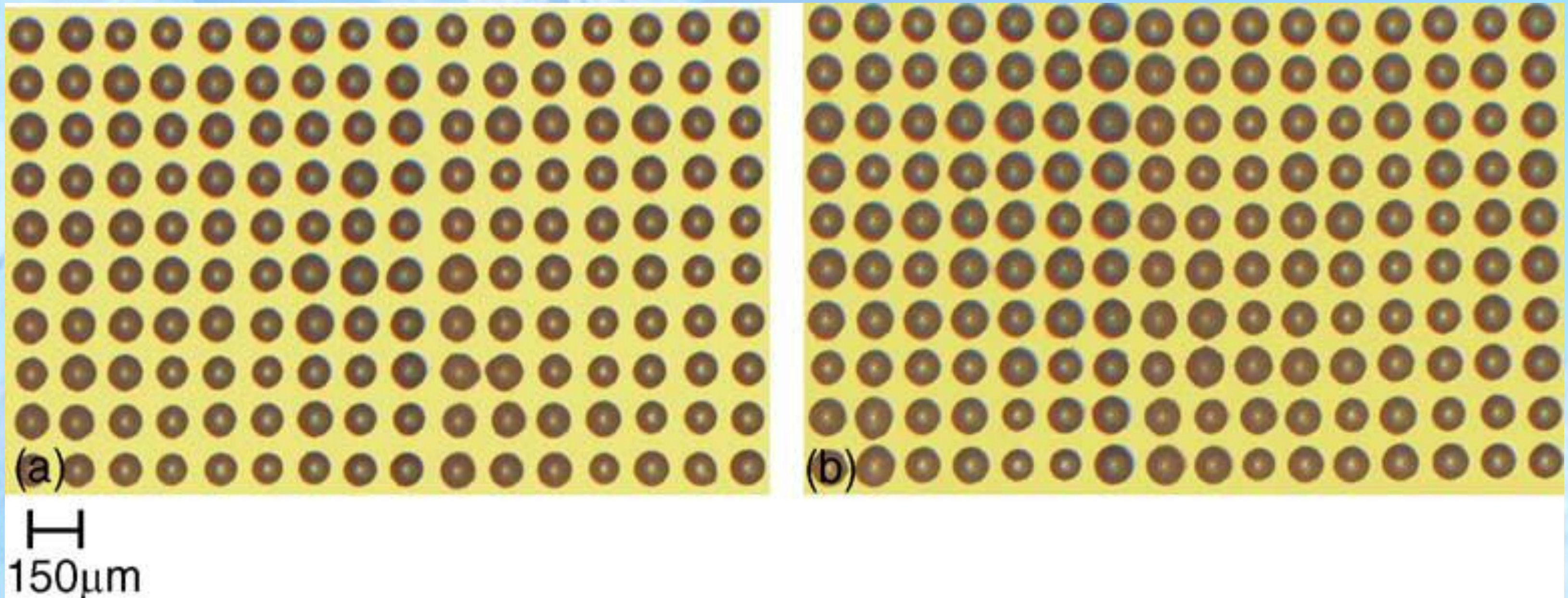


Fig. 5: Shows the possibility of transferring a matrix of homogeneous and uniform circular shapes to a receiving material. From Ref. M. Colinaa,∗, P. Serraa, J.M. Fern´andez-Pradasa, L. Sevillab, J.L. Morenzaa, Received 21 May 2004; received in revised form 28 July 2004; accepted 4 August 2004,

It is clear from the above results that it is possible to produce micro and nanodevices which cannot be seen by the naked eye and can in principle be used as bugs to communications and computer system and networks. Accordingly those unseen devices can be a threat to national security and economy.

One important achievements has been performed by the research team led by Prof. Roman Sordan of the L -Ness laboratory in Como-Italy. Using grapheme, the group developed graphene nanoelectronic devices producing the first logic gates and the first integrated circuit which is shown in fig. 6 and fig. 7.

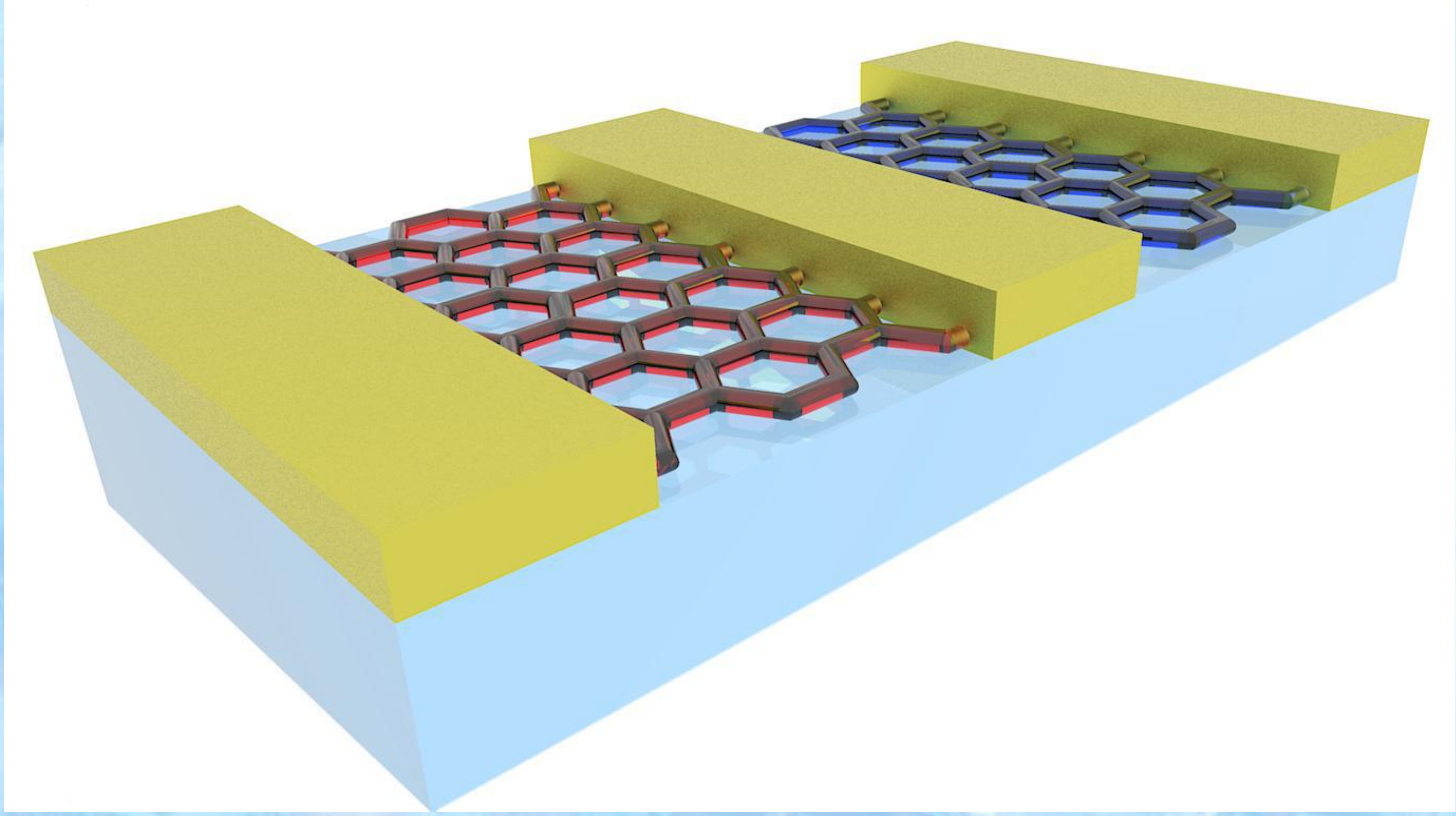


Fig. 6: Logic gates using graphein. From Ref. F. Traversi et al, Appl. Phys. Lett. 94, 223312 (2009)

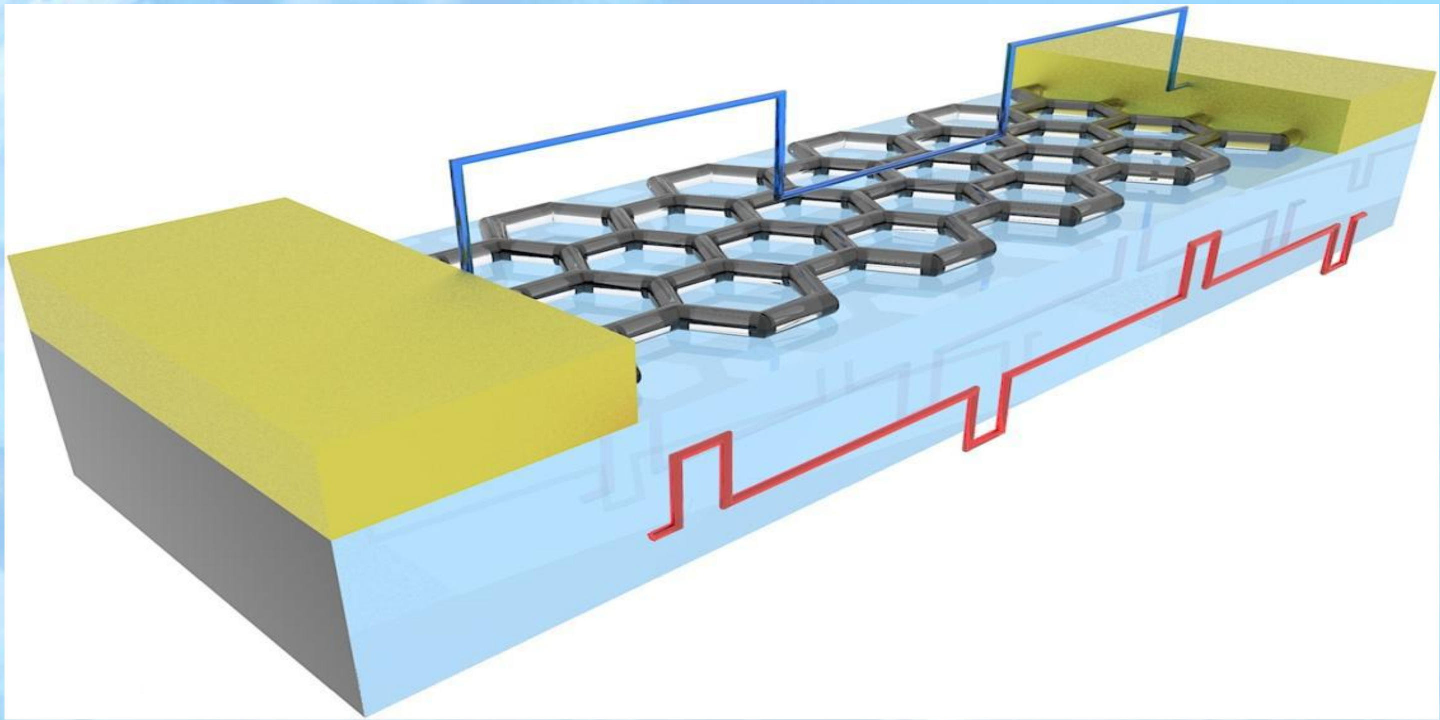
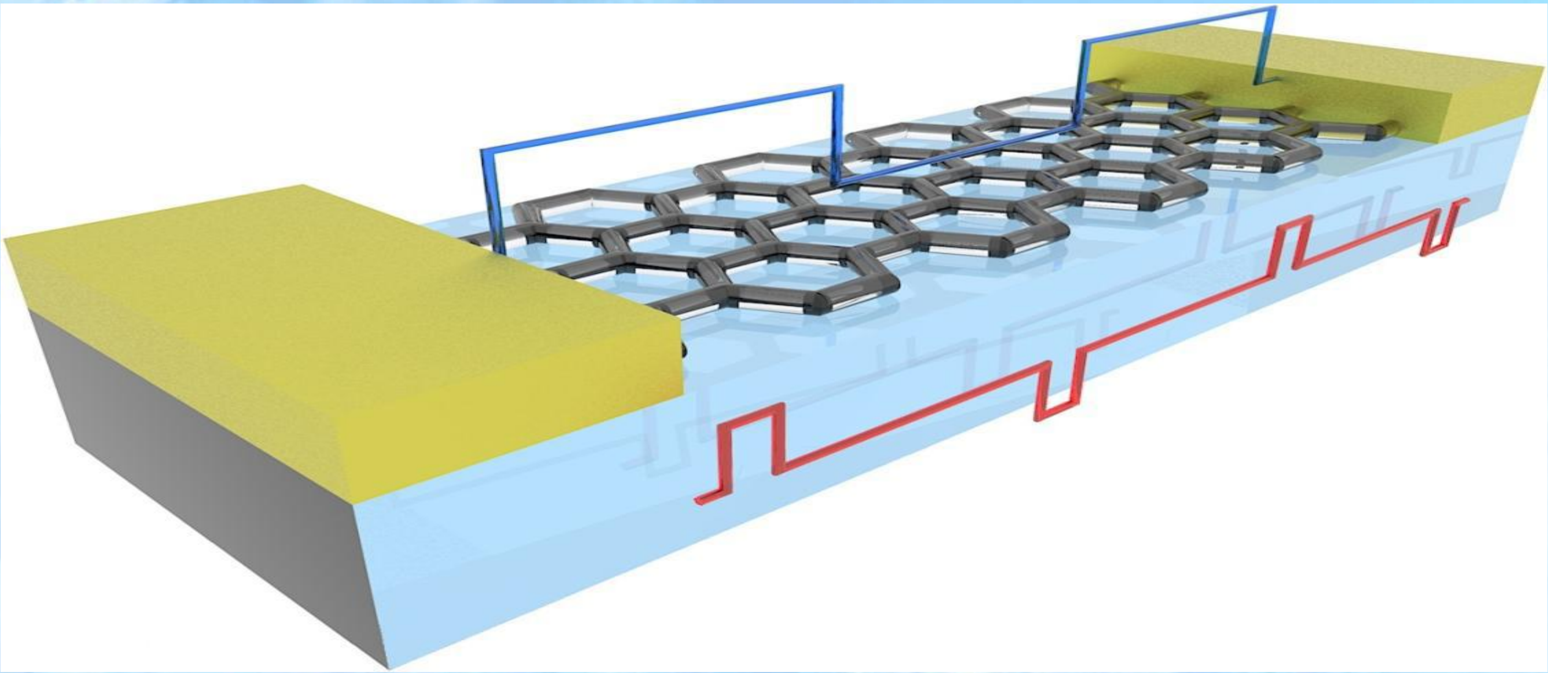


Fig.7. Graphene Nanoribbon Memory Cell . From Ref. CNTs: J. B. Cui et al, Appl. Phys. Lett. 81, 3260 (2002) E. U. Stützel et al, Small 6, 2822 (2010)Curtsy: Nanoscale Device Group, L-NESS Como, Italy lness.como.polimi.it/ndg.php F. Traversi, L. Rizzi, F. Nichele, L. Polloni, M. Bianchi



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- Nanoimprint Lithography-NIL
- **NIL can be performed by physically deforming a thermoplastic material in a temperature and pressure controlled printing process.**
- **It was done using a silicon stamp patterned by electron beam lithography and dry etching. It can be performed using for example, Thermal wafer scale NIL, UV wafer scale NIL, UV step and repeat.**
- **The Substrate Conformal Imprint Lithography (SCIL) technique combines the advantages of a soft composite working stamp**
- **for large area patterning with a rigid glass carrier for low pattern deformation and best resolution. SCIL uses a sequential imprinting principle that applies capillary forces instead of backside pressure, which minimizes air inclusions even on large areas,**
- **ensuring highest uniformity.**
- **The sequential separation of stamp and substrate avoids high forces and allows for a clean and reliable disconnection without damage to the patterned structures. The excellent performance in respect to substrate conformity and pattern fidelity over large areas makes this imprint technology a powerful tool, especially for applications**
- **like LED/VCSEL, optical elements, patterned media or functional materials such as printed electronics or RFIDs.**
- **SCIL was developed by Philips Research, Eindhoven, and transferred to SUSS MicroTec in a technology**

Example of obtained results at SUSS and [***]iX-factory GmbH, CEO for this research work is shown in fig.8

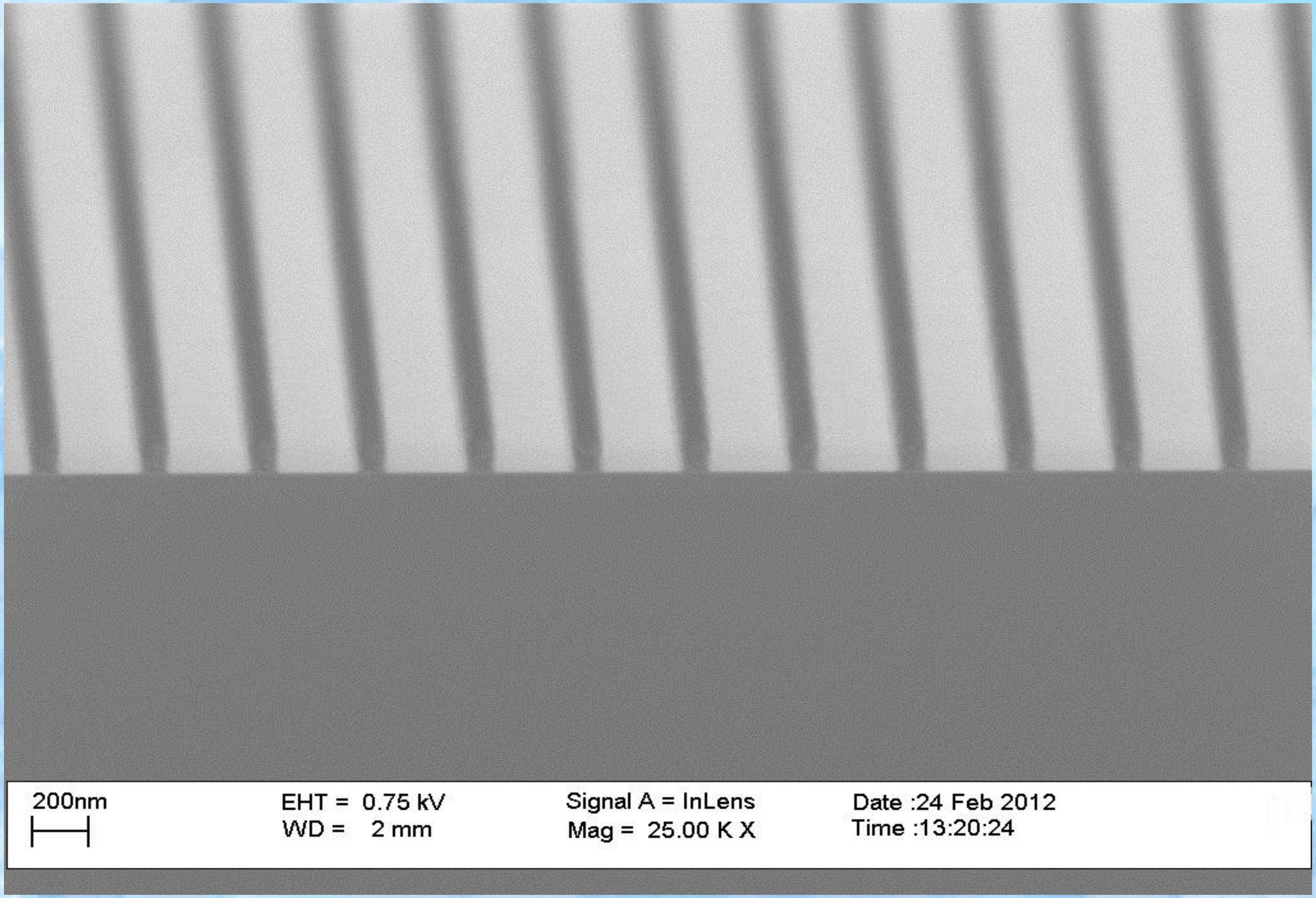

Fig. 8. High resolution structures imprint