Opened a new type 3D printing, resolution 3D printing increased by 1000 times.

Andrea Lenz, Korolev Daniil Leonidovich.

Opened a new type of 3D printing based on assembly from ion beams. The new type has a print resolution of better than 30 nanometers. This feature and self-assembly of this printer open the way to new types of technology.

Today, there are a lot of projects equipment and products in the field of nanotechnology, but modern technology cannot adequately implement them because of the impossibility of creating high 3D nanostructures, despite all the advances in 2D technology. Modern technology spend hundreds minutes for creating a structure of thin layer. Consequence: the creation of high 3D nanostructures with good resolution will go for decades. However, it is these structures are necessary for many products.

Conventional 3D printing[1] also cannot solve these problems. Minimum resolution of modern type 3D printers 30 micrometers. In addition, modern 3D printing has limitations in the used materials.

In microelectronics used multibeam electron lithography [2, 3]. What would happen if instead of electrons to use ions? This will open up new opportunities, and products, there will be new problems. We developed a 3D printer based on the assembly from ion beams with a resolution better than 30 nanometers, and without limitation in the used materials. Progress by 1000 times. This printer removes the drawbacks of modern technology. This fact and self-assembly of this printer open the way to new types of technology.

The principle of working of the new 3D printer.

Printer based on assembly from ion beams [4, 5]. Ion source accelerates ions at precisely controlled energies through a plate with channels, in a compound electrode. The electrostatic field of the electrode retains ions from contact with the walls. Ion beams pass through the channels of the printer on the table assembly. The printer is moving, this ensure complete coverage of the area of the press and the maximum tight fit to the surface of the printer application. The ions settle layer by layer, creating an object. By changing the composition of the ions, shutting the flow of ions from the channels you can collect the desired object with any form, of any material.

Important advances in thin ion beams.

15 years ago, researchers in the University of Berkeley, have created a matrix management of ion beams. The researchers did not appreciate the importance of research. They have created a semblance 3D printer, but in order to lithography and alloying, not a full-fledged assembly facility[6]. «In the MMRL, an ion source accelerates ions at precisely controlled energies of some 20 electron volts through a "universal pattern generator," an array of fine holes, each a micrometer in diameter, in a compound electrode 40 micrometers thick. Each hole forms an ion beamlet 100 nanometers thick, which can be switched on or off to create any desired pattern. Instead of a dozen separate masks, a dozen different patterns can be programmed to quickly succeed one another. »

9 years ago by Carl Zeiss has launched production of ion microscope with a beam of helium ions of less than 1 nm thick[7]. «Carl Zeiss SMT has said that it has set a new record resolution benchmark for scanning electron and ion microscopy, using its ‘ORION’ Helium- ion microscope. A surface resolution of 2.4 Angstrom, the company said.»

The main problems of the proposed 3D printer.

1. Problem: growth substance on the control panel ion beams. The problem of overgrowing matrix channels because of unused ions. Consequence: the matrix cannot reproduce itself, it is short-lived.

2. Problem: of charge accumulation in the dielectric. Consequence: the repulsion of the ions from the thick dielectric layers.

3. Problem: the possibility to separation the collected matter and create cavities. Consequence: it is impossible to manufacture products with movable elements and separation of product from the table assembly.

These and other issues have been resolved. Methods of the decision is contained in this article will not be, it is trade secret.

Capability, distinctive features and benefits of the new 3D printer.

1. Precision resolution. Print resolution is better than 30 nanometers. This level of modern microelectronics industry. Possible resolution of less than 1 nanometers, it is better resolution than the resolution of any modern lithography. Comparison with other 3D printers showing even greater progress. The best existing 3D printer has a resolution of 30 micrometers. Progress over 1000 times.

2. Easy to manufacture products. All process can be carried in one block. All components can be manufactured in one machine, in a single process. No need a surgery: growth crystal, cutting plates, polish plates, cleaning plates, infliction resist, combination of masks and plates, lithography, etching a unnecessary resist, etching a unnecessary layer, deletion resist, planarization, application of metals and dielectrics, doping, epitaxy, annealing, transfer plate, separation of chips, packaging of chips.

3. Self-assembly of the printer. The printer can create their own copy and printer with better resolution and larger printing area, it is impossible for other 3D printers, and any existing machine. Print resolution (the thickness of the ion beam, roughness) can be made much thinner than all the elements of the printer, it will allow the printer to reproduce itself and create a copy with the best characteristics. It is impossible for other 3D printers, in which the roughness will always be greater than the width of the channel, it is does not give the opportunity to create a complete copy of the printer.

4. The strength of the product will be higher than at other types of 3D printing. This is due to the disadvantages of other types of 3D printing.

5. The product may consist of any materials, perhaps any allocation materials. This is due to the possibility of the formation of ions from any material, other types of 3D printing have limited in material selection printing.

6. Ability to collect new items that are not available to create a planar technology and existing types of 3D printing. This is due to the limitations of planar technology and a conventional 3D printing.

Examples of products that can be create a 3D printing.

1. Super productive 3D processor[8, 9], on the one-electron transistors, the ability to create computing devices like brain.
2. Multilayer computer memory[8, 9], the capacity of which will be in the hundreds of thousands of times greater than today's.
3. Multichannel conductor's information based on electrons and photons with a capacity of more than a terabyte. Home internet at a speed of more than a terabyte.
4. Super productive cooling system based on moving ropes in the channels.
5. A contact lens with a laser projector creates an image on the retina.
5. Brain–computer interface based on millions of mobile wires, which can penetrate into the body and connect to the nerves. This allow create a prosthetic eye and other body parts, as well allow create a complete virtual reality.
7. Microrobots and nanorobots.
8. Trouble-free means of contraception based on microrobot.
9. Small robots insects and cheap surveillance camera[10]. They will open up new opportunities in the intelligence service, the rule of law and monitoring the animals. Robots insects will be able to listen even places like Putin's office and the capital of ISIS.
10. On the basis of this printer, can create completely self-replicating robots, thus creating an analogue of life and cheap workers.
11. Cheap thin-film solar cells, unwinding on the ground, with built-in power inverters.
12. New types of detectors and sensors, for example: imitation leather for robots.
13. New types of tools, detectors, laboratory for the: analysis, biology, physics, chemistry, photonics, quantum physics.
14. New types of surgical instruments. Micro mechanisms allow operating with nerves and effectively removing the cancer.
15. Differential sail[11], if it is possible, it miracle of science radically improve human life.

Outcome.

A new type of 3D printing could revolutionize the field of microelectronics and instrument making and with good reason. In its functional 3D printer is unique among 3D printers, factory and technologies. The performance of nano layers will be close to the largest microelectronics factories, but this printer cost millions of times less. For the first time designed completely self-replicating 3D printer, which opens the way for the creation of self-replicating robots. Possible print resolution, better than 1 nm exceeds any existing lithography techniques and topological rules of the microelectronics industry, together with 3D printing opens the door to the best types of microelectronics. Products that can be created on it can dramatically change the face of modern life and its branches. Experiments in the University of Berkeley prove the possibility of creating such a 3D printer. The main problem will now be funding the creation of the first self-replicating 3D printer and programming model. Can recognize that the future of microelectronics and instrumentation - a multi-beam ion assembly.

References.

1 Encyclopedia Wikipedia. 3D printing.

Wikipedia

2. Encyclopedia Wikipedia. Mapper Lithography.

Wikipedia

3. Mapper Lithography company. Multibeam electron lithography.

Mapper Lithography

4. Encyclopedia Wikipedia. Focused ion beam.

Wikipedia

5. Mackenzie, R A D. Focused ion beam technology: a bibliography. (1990)

IOPscience

6. Berkeley Lab Plasma Ion Source и Technology Group AFRD Tsu-Jae King, Quing Ji, Vinh Ngo, and Karen Scott, Leung. Multibeam ion lithography. (2000)

Berkeley Lab

7. Journal Fabtech. Microscopy resolution record claimed by Carl Zeiss. (2008)

Fabtech

8. Encyclopedia Wikipedia. Three-dimensional integrated circuit.

Wikipedia

9. Journal TechRadar. 3D processors, memory and storage explained. (2011)

Techradar

10. Festo company. Fantastical Insectoid Robots Include Bionic Ants and Butterflies. (2014)

Festo

11. Korolev Daniil Leonidovich. Found material creates a unidirectional force due to vacuum fluctuations. (2015)

Vixra

Author information.

These authors contributed equally to this work.
Andrea Lenz
Korolev Daniil Leonidovich

Affiliations.
PEBTAP company (Progressive Electronic Best Technologies Advanced Programs company).
Contact: pebtapcompany@gmail.com
Andrea Lenz. Contact: andreascientist@gmail.com

Ion Assembly Group.
Contact: ionassemblygroup@gmail.com
Andrea Lenz. Contact: andreascientist@gmail.com
Korolev Daniil Leonidovich. Contact: corolyowdaniil@gmail.com

Contributions.
Andrea Lenz created important engineering ideas, sought and solved hidden problems, studied and modeled processes. Korolev Daniil Leonidovich proposed the idea of the printer, created important engineering ideas, perhaps opened Differential sail. All authors commented on the manuscript.

Competing financial interests.
The authors declare: 1. This article is a summary of research Ion Assembly Group. 2. This article is written with the consent and participation a Ion Assembly Group. 3. No competing financial interests of others persons and organizations.

Corresponding author.
Correspondence to: Korolev Daniil Leonidovich.