



Innovation news

Scientists developed a new 3D printing method

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3D printing becomes more and more popular and scientists constantly startle the world with new inventions. 3D printing technology developed by Carbon3D Inc. enables to create solid objects from liquid material, not a layer upon layer as it was before. So it totally differs from the traditional method known for the last 25 years and presents an entirely new approach in this field. A paper concerning specific features of this technology has been published on 20th March in the Science journal, according to science and engineering news. As reported by the authors, the developed technology opens up a possibility to create items 25 to 100 times faster and to make previously infeasible geometric shapes. This opens a route for innovations in different areas, particularly in medicine, automobile industry, and aviation.

A technique named CLI (Continuous Liquid Interface Production) operates with light and oxygen and “produces” objects in a liquid medium. A minimum size of the object that can be created with the use of the “liquid” 3D printer is just 20 micron.

Having reconsidered the entire approach to 3D printing and re-analysed fundamental chemical and physical processes the scientists developed a new method enabling to produce items much faster. A ready-made object just “emerges” out of a liquid bath.

Currently Carbon3D improves its technique and tries to adapt new materials for it. Theoretically, using the CLI technique will enable to use a number of materials, such as elastomeric and silicone materials, nylon, ceramics, and biodegradable materials.

Classic 3D printing technique made a real breakthrough in science and found use in many fields. Moreover the 3D printing is nowadays used not only in industrial production, it has become more affordable. Undoubtedly the new method will be used widely too.

Scientists made a material changing its colour

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Engineers from the University of California, Berkeley, created an ultra thin material which can change its colour by application of just minor efforts. This piece of news was recently published on sciencedaily.com, according to science and engineering news.

The new material is considered highly advantageous because it will enable to make displays of new class, military camouflage paint capable of colour changing, and sensors which can detect defects of building invisible to the naked eye.



Scientific research loses its value

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Each day we find information about results of new scientific researches. At first glimpse it seems that they all are of great practical utility. Nowadays it is considered classy to study abroad and ambitious scientists often leave for foreign countries where they hope to get more opportunities for research. Since the scope of scientific knowledge increases year by year, the scientists from

Aalto University in Finland decided to investigate if the findings of all these studies can be taken into consideration.

It was found that scientific research, just like money, loses its value when abundant. Papers and research studies are the currency of science. The problem is that at present there are too many of them. This conclusion was obtained by scientists from Aalto University. In their study “Scientists lose attention” they answered a question of whether scientists are able to process all the published research results.

Nowadays the scientist publish much more research results than even in the 1970s. Every 9 years the amount of scientific knowledge doubles.

Italian scientist Briotta Parolo and his colleagues analysed the time interval required for new publications to start being cited in further papers. Indeed, citation of research papers is a good indicator of importance of those papers for a certain professional field. The study was based on 23 million research papers from four different areas of expertise, namely: chemistry, physics, medicine, and molecular biology. Internet site Web of Science, developed by Thomson Reuters company was taken as the source of papers. The analysis being so extensive, its outputs were unambiguous. Notwithstanding the fact that citation quota increases sharply immediately after the release of a new paper, it reaches its peak value rather quickly and then in a short time it suddenly decreases. Thus, new published papers and studies disappear much faster than 40 years ago. The major concern is caused by the fact that in the last years the citation factor curve demonstrates a headlong fall.

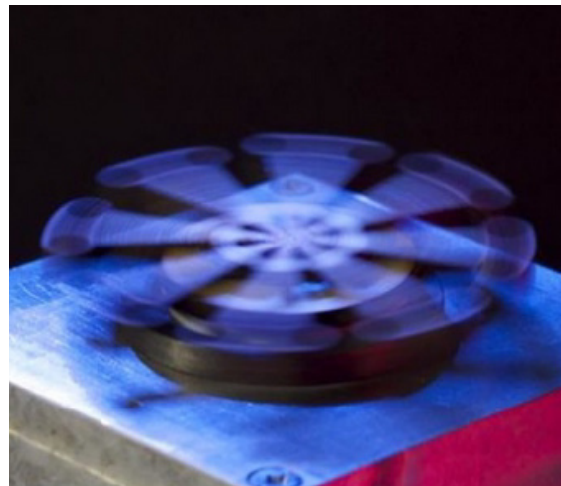
Engine based on Leidenfrost effect can provide power supply for Martian colonists

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Thanks to investigations of scientists from Northumbria University (Great Britain), Martian colonists will be able to produce energy from carbon dioxide. This piece of news was published on web-site ScienceDaily, according to science and engineering news.

The scientists proposed a design of the engine capable of producing energy based on a phenomenon known as the Leidenfrost effect. This effect occurs when liquid gets in contact with a surface the temperature of which is much higher than its boiling point. Pieces of carbon-dioxide ice, frozen CO₂, can levitate above hot surfaces and hover over the layers of its own pair. Researchers from Northumbria University found out a method to produce energy from this pair, sufficient to drive the engine. This is the first and rather successful case when the Leidenfrost effect was used for energy production.

Hence a one-way trip to Mars becomes less and less crazy looking.



Korean scientists made lightweight but strong steel

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Although oil prices decrease permanently, the issue of fuel saving still remains of great importance for auto manufacturers. To reduce fuel consumption it is necessary to make an auto of lighter materials. It is well known that the auto weight reduction by 1/10 allows to save 6 – 8 % of fuel.





Steel is the main material required for automotive industry. Other materials are either more expensive or their machining is more difficult. For this reason the issue of production of steel which is lighter and at the same time still strong and elastic is extremely important. The method of production of such steel was described by a team of scientists from the Pohang University of Science and Technology (South Korea). The scientists report that the steel microstructure outperforms even titanium-based alloys in terms of flexibility and strength.

Sang Hyeon Kim and his colleagues made steel which combined useful properties of austenite and B2, such as elasticity and hardness. The researchers have been already cooperating with South Korean company POSCO, one of the biggest steel manufacturers, with the aim of industrial use of results obtained by them. In recent years the steel production has reduced in the majority of developed countries. However this is not the case with South Korea which has strong automotive industry and where steel production has increased nearly by 50 % since 2005.

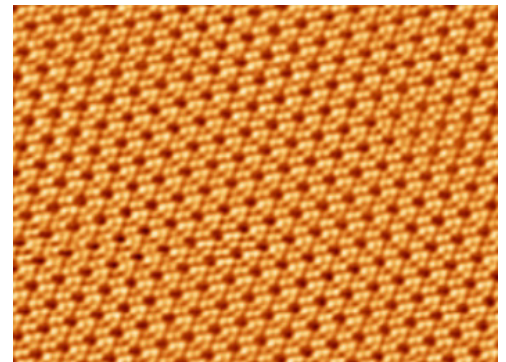
Scientists built the world’s first silicene transistor

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For the first time, scientists used silicene to build transistors. Probably this achievement will become a first step on the way to computer chips which will operate thousands times faster than all those available nowadays.

Silicene having by-name “graphene’s cousin” is an analogue of graphene but its honeycombs consist of silicium atoms instead of carbon atoms. Silicene was highly vaunted as a super material and for several years scientists tried to find a design method for silicene transistors. The first who managed to discover a correct approach was Deji Akinwande, computer engineer at the University of Texas, and his team. The innovative method has been described in the journal Nature Nanotechnology.

Scientists have been suspecting a probability of silicene existence for two decades but material scientists managed to create it in 2010 only. This was a breath-taking discovery because silicene has got fantastic electric properties due to which the computing techniques can be revolutionized.



Russia will build radars on the basis of nanophotonics

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Two leading Russian institutions of the defence sector of industry, The Advanced Research Foundation (ARF) and Joint-stock company Concern Radio-Electronic Technologies (KRET) have announced the beginning of joint activities in implementing an innovative project in nanophotonics area. The developments aim at creation of new generation radars operating based on interaction of signals of optical and microwave band using nanometer-scale structures.

The base for the new project will be existing engineering developments in the area of radio photonics, a specific trend in applied physics. Radio photonics and microwave photonics studies interaction and propagation of optical and microwave band signals and their interaction with nanoscale objects.

The project participants play a major role in the defence sector of the country. ARF was established for preparation of conditions for implementation of complex scientific research in the defence area

in Russia. KRET comprises 97 enterprises where development and production of radioelectronics for the defence sector is a high priority business line.

At the first stage of investigations it is planned to invest 680 mln rub. According to estimation by Nikolai Kolesov, Director General of KRET, communication surveillance systems will be built in the mid-term perspective in Russia; their capabilities will significantly exceed the capabilities of the existing device series. The expectable term of innovation systems development is 2020. This project is intended at design of components of active phased array for radar stations with the use of microwave nanophotonics technique.

Challenging future of nanophotonics is also proved by interest to this line of business in other countries, including the defence establishment in the USA. Not long before the solution taken by ARF and KRET, the Air Force Research Laboratory (USA) announced a grant project placement for creation of a specialised institute of nanophotonics. The purpose of this entity is preparation of conditions for production of photonic integrated circuits. The minimum volume of the project financing is \$220 million, among which \$110 million are the allocated grant and the rest of the sum are investments from non-government sources. The amount of the latter ones shall be equal to at least the grant volume.

The task of the new institute will be the improvement of available state-of-the-art developments in the area of production, testing, and assembly of photonic integrated circuits.

Innovative aircraft will deliver passengers anywhere in the world within 4 hours

Published: “Mir nauki i tekhniki” on December 19, 2014.

British company British Aerospace is at work on engine which will enable to deliver 300 passengers anywhere in the world within just four hours. And what is even more impressive, these engines will be able to bring aircraft to cosmos, says Business Insider.

The engine referred to as SABRE is unique by its air cooling technique. The incoming air is cooled down to -150 degrees within 0.01 second. This means that it will be possible to run the engine at much higher power that it is possible at present.

A passenger supersonic airplane LAPCAT A2 will be equipped with the SABRE engine. This aircraft will perform commercial flights. For example, the flight from Brussels to Sydney will take only 3:58 hours. Another ambitious project Skylon is in the works as well. Skylon is an airplane aimed to provide cheap space flights.

As explained by Chief Engineer Alan Bond, LAPCAT A2 will be able to fly “rather easily” around the world at incredible speed – five times faster than sound speed. The precooling system weights about one tonne and consists of a system of thin tubes filled with liquid helium.

The Company has been already testing the engine system SABRE and is planning to carry out first test flights in 2019.

Skylon airplane will be 82 meters in length, and though it will fly like a rocket in the air, it will take off and land in horizontal position like a normal airplane which makes it more universally applicable. The model cost is about \$1.1 billion.

Unfortunately, the airplane will have no windows. But probably it will be equipped with external cameras and the image will be displayed on inner walls. Just imagine how spectacular it is to see the surrounding environment during a cosmic space flight.

Next generation of supercomputers will be produced in 2017

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Two US laboratories have ordered supercomputers from IBM, which should become the most powerful in the world, according to science and engineering news. Fulfilment date – 2017. Total cost of two supercomputers is \$235 million. Their basic capacity will be 150 petaflops or 150×10^{15} peta floating point operations per second. This is nearly 5 times more than the capacity of nowadays operating US champion Titan located in the Oak-Ridge National laboratory, Tennessee.



One of the supercomputers will be delivered to the Oak-Ridge National laboratory, and the second one – to Lawrence Livermore National Laboratory, California. At present the most powerful supercomputer in the world, Tiānhé-2, is situated in China. Its power equals 55 petaflops.



British specialists created a “holographic” radar

Picture: Aveillant

British company Aveillant has developed a new radar station which does not comprise any movable parts and is capable of continuous 360-degree scanning of environment. As reported by Aviation Week, the company describes its radar as “holographic” and the project is named Theia. The specific feature of the station is its capability to perform detailed scanning of environment without narrowing of viewing angles or decrease of data shaping in other directions.

The Japanese created ultra-hard “steel” glass

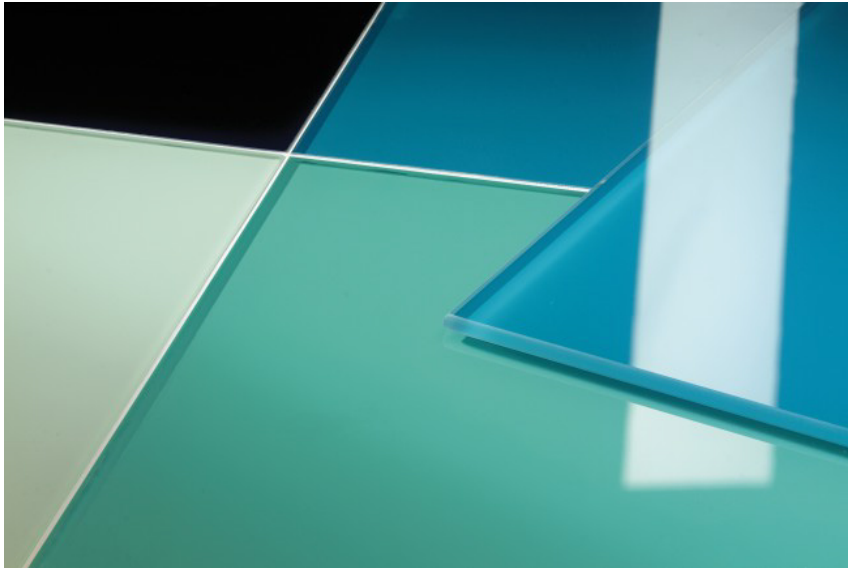
Japan scientists created glass which is as strong as steel. This development will lead to generation of a new type of material which promises to revolutionize the glass applications. The new technology will be available for users within the nearest five years.

Application field of the ultra-hard glass is unlimited. The new material will protect building façades from destruction in case of a natural disaster, and display cracking in case of smartphone falling down will be a problem no longer. Nonsplintering safety glass in cars will eliminate negative consequences in case of car crashes.

All this will be possible thanks to development carried out by specialists of the University of Tokyo’s Institute of Industrial Science who have found a method to improve glass strength up to the steel level, with the glass remaining light-weight and thin.

The secret of the new material is the use of larger amount of aluminium oxide than before. It is a common fact that aluminium oxide improves mechanical strength of glass. All past attempts of researchers to increase the amount of aluminium oxide in the mixture were not successful – glass ceramed during the manufacture process in container.

The scientists managed to solve this problem having excluded the mixture contact with the container. The glass was produced in a special furnace with levitating compounds using gaseous oxygen and carbon dioxide laser. The produced glass was transparent and at the same time it contained 50 percent of aluminium oxide, as reported in International Business Times.



The test demonstrated that the new material was twice stronger than normal glass and with regard to this parameter is could compete with steel and cast iron.

DARPA specialists work on ICARUS Program – drone which can literally dissolve upon operator’s command or in case of falling into water

DARPA is going to build drones whose capability to dissolve becomes its key characteristics. The agency is planning to create drones which can make only one flight. As a result, a drone shall be built which will disappear within four hours after cargo delivery or within half an hour after twilight beginning. The drone will be able to deliver cargo weighting up to 1.4 kg within the radius of 10 meters from the target. ICARUS drones will be released from air-balloons at the altitude above 10 thousand meters and then they shall fly 145 kilometres, minimum. Total wingspread of the drone shall not exceed 3 meters. DARPA invests \$8 million in the project and expects to obtain a working prototype within 26 months.

