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Q-Carbon: A New, Inexpensive and Affordable Diamond in Everyones Hand

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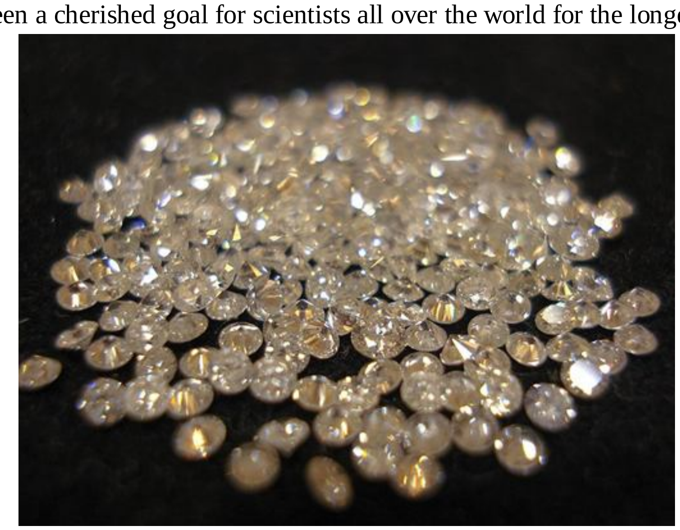
Abstract: Q-carbon is an allotrope of carbon, discovered in 2015, it is ferromagnetic, electrically conductive, and sometimes it glows when exposed to low levels of energy. It is quite inexpensive to make, and may be it is a replacement of diamond because it is the hardest substance like diamonds. According to researchers, Q-carbon exhibits a random amorphous structure that is a mix of 3-way (sp^2) and 4-way (sp^3) bonding, rather than the uniform sp^3 bonding found in diamonds. Carbon is melted using nanosecond laser pulses, then quenched rapidly to form Q-carbon, or a mixture of Q-carbon and diamond. Q-carbon can be made to take multiple forms, from nanoneedles to large-area diamond films. Few of the researchers are also able to create nano size diamond and organize them for a variety of potential applications, ranging from nano sensing and quantum computing to biomarkers.

I. INTRODUCTION

"The crown which diamond wore of "World`s Hardest Substance" is now at the verge of being taken by "Q-carbon"
New phase of carbon .Scientists call it Q-carbon and after diamond and graphite it is the third solid phase of the element . "Converting carbon to diamond has been a cherished goal for scientists all over the world for the longest time[1],"



Q-carbon is an allotrope of carbon, discovered in 2015, that is ferromagnetic, electrically conductive, and glows when exposed to low levels of energy[2]. It is relatively inexpensive to make, and some news reports claim that it has replaced diamond as the world's hardest substance. It is announced in the year 2015 by the researchers at North California State University .Ancient scientists[3] , lon ago tried to master the craft of alchemy(a process of turning lead into gold) but it was proven to be a hopeless task.

II. PREPARATION

Diamonds are hard to make. Now, after decades of testing scientist have discovered a speedy way to make diamonds that can be done without squeezing carbon under extreme pressure or heating it with conventional baking[4].
Q-carbon is like crafting the new hardest rock on the block as it is very close to its carbonaceous cousin DiamondBut the scientists of the modern era have successfully unlocked the secret chambers to a stunning transformation : turning carbon (basic building block of life)into diamond.Carbon is melted using nanosecond laser pulses, thenquenched rapidly to form Q-carbon, or a mixture of Q-carbon and diamond[5]. A distinct new solid phase of carbon with the potential of converting into diamond as easy as making a

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toast. Q-carbon can be made to take multiple forms, from nano needles to large-area diamond films. The complete process of making a Q-carbon is relatively inexpensive .It is all done at room temperature and pressure.It took researchers only 15 minutes to make one carat of Q-carbon. The initial research created Q-carbon from a thin plate of sapphire coated with amorphous (non-crystalline) carbon[6]. Further studies have demonstrated that other substrates, such as glass or polymer, also work. It glows more than diamond when exposed even to low levels of energetic radiation because of its stronger negative electron affinity.

III. STRUCTURE

Carbon has an ability to exist in different forms and Q-carbon is an allotrope of carbon . Phases are distinct forms of the same material. Graphite is one of the solid phases of carbon; diamond is another.According to researchers, Q-carbon exhibits a random amorphous structure that is a mix of 3-way (sp^2) and 4-way (sp^3) bonding, rather than the uniform sp^3 bonding found in diamonds. It is being said by the researchers that it is 60% harder than diamond .“This was a closure to a lifelong effort” said Mr.Narayan[7] , 1st paper published in this subject was on 1979 followed by papers in 1991along the way and then finally Q-carbon happened .

When carbon goes into new structural arrangements, exciting properties can arise , but the fingerprints of this amorphous carbon are quite complex .The researchers created Q-carbon by starting with a thin plate of sapphire . Using a high-power laser beam, they coated the sapphire with amorphous carbon, a carbon form with no defined crystalline structure. They then hit the carbon with the laser again, raising its temperature to about 4,000 Kelvin, and then rapidly cooled, or quenched, the melted carbon. This stage of quenching is where "Q" in Q-carbon comes from. Instead of interlocking in the neat lattices of diamonds, carbon tetrahedrals jumbled together in an amorphous heap. It’s as if someone smashed a diamond’s structure, but left most of its individual building blocks intact, Narayan says. From these building blocks, the team could grow tiny dots, films and needles of diamonds by providing the seeds for crystal growth.

IV. PROPERTIES

The properties of Q-carbon are quite exciting .Q-carbon is non-crystalline, and while it has mixed sp^2 and sp^3 bonding, it is mostly sp^3, which leads to its unique hardness and its electrical, optical and magnetic properties. Q-carbon is harder than diamond by 10–20% because carbon is metallic in the molten state and gets closely packed, with a bond length smaller than that in diamond. It is ferromagnetic, unlike all other known forms of carbon , estimated Curie temperature is about 500K and saturation magnetization value of 20 emu/g, has mixed sp^2/sp^3 form , electrically conductive and glows when exposed to energy - even low energy levels . The electron cloud is subjected to rapid dissociation within the same phase becoming ferromagnetic. It is nearly 60%harder than diamond.

V. APPLICATIONS

Potential technologies include high-powered electronic and photonic devices, high-speed machining, deep sea drilling and biomedical sensing. Q-carbon's low work function and negative electron affinity make it an attractive alternative for efficient field emission displays. “Q-carbon’s strength and low work-function – its willingness to release electrons – make it very promising for developing new electronic display technologies.

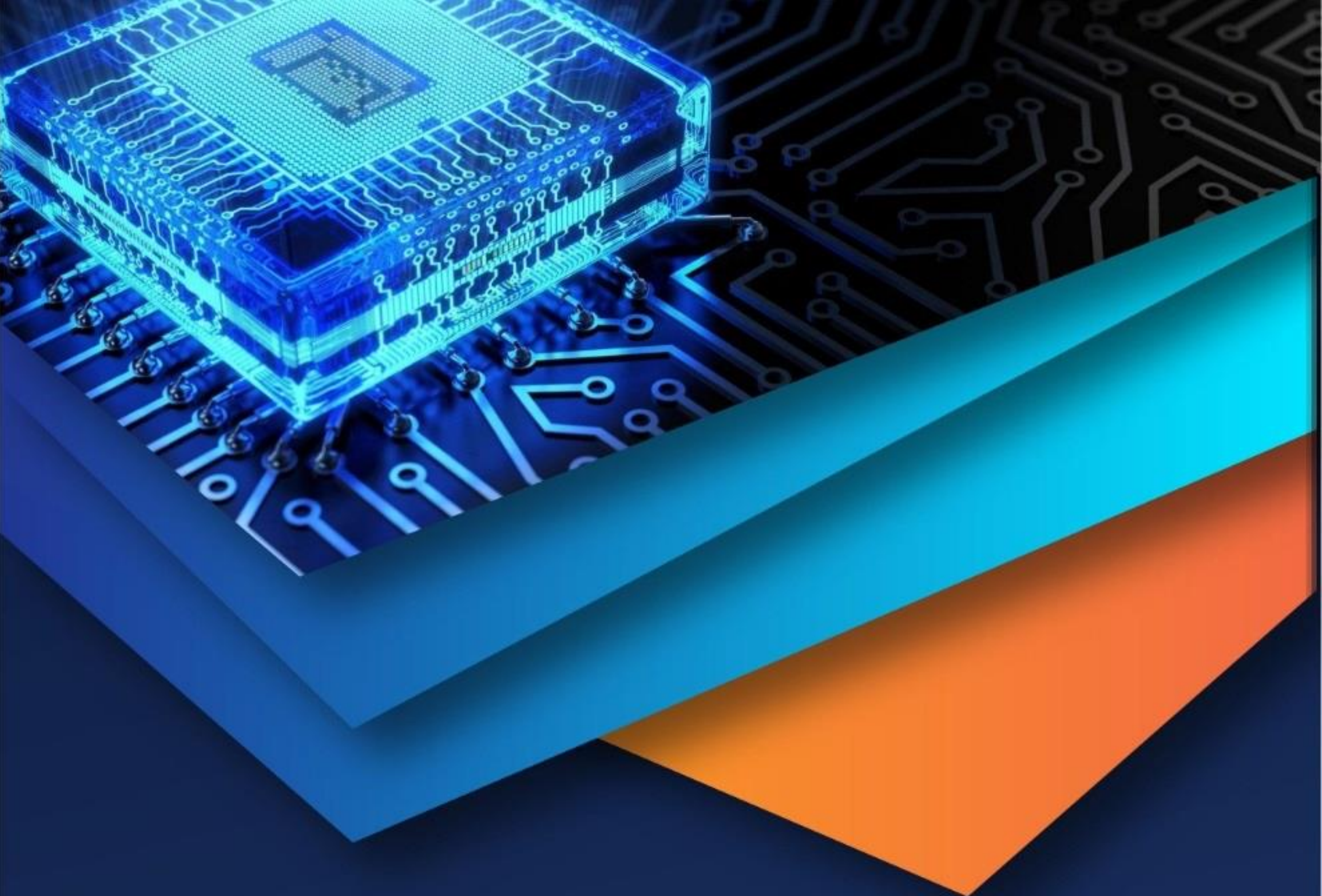
It also opens the possibility of novel quantum nanotechnologies in the physical and biological sciences: for example, single photon sensors, nanoscale electronic and magnetic sensing, single-spin magnetic resonance and fluorescent biomarkers. Its more immediate use, though, is aiding diamond creation.It can also be used to make diamond structures by first making Q-carbon from a substrate like glass or plastic polymer that is coated with elemental carbon, hit with a laser pulse and then rapidly cooled in a precisely controlled manner. By slightly changing the rates at which the molten carbon cools, the scientists can use it to grow crystals of diamonds in a bunch of forms, such as nano needles, micro needles, nano dots and films[8].

VI. CONCLUSION

The unusual properties of Q Carbon make it ideal for all sorts of applications like from electronic displays to abrasive coatings on tools to biochemical sensors that are compatible with the body . Q-carbon's first useful application will be in creating "a diamond factory for nano products" for use in drug and industrial delivery processes. it can manufacture smartphone screens or in electrical components . "It will take something in the order of 15 minutes to create one carat of diamond," It can provide tools for industry and medicine or for creating brighter long lasting display technologies . Q-carbon is “potentially lucrative” . This bizarre material is even tougher than diamond, is magnetic and emits a soft glow. Aside from its role in making faster, cheaper diamonds, Q-carbon could find uses in electronic displays.

REFRENCES

[1] Narayan, Jagdish; Bhaumik, Anagh (2015-12-07). "Novel phase of carbon, ferromagnetism, and conversion into diamond". Journal of Applied Physics. 118 (21): 215303. ISSN 0021-8979.
[2] Graphene - The Nano Carbon Wonder, N. Ram, Jaya Pandey, RichaKhare and Smriti, International Journal of Advanced Research in Biological Sciences. 2 (3) March, 2015, ISSN No 2348-8069,
[3] Roston, Brittany (Nov 30, 2015). "Researchers create diamond at room temperature".
[4] Bromwich, Jonah (2015-12-03). "New Substance Is Harder Than Diamond, Scientists Say". The New York Times. ISSN 0362-4331.
[5] CNN, Ben Brumfield. "Q-carbon is harder, brighter than diamonds". CNN
[6] "Q-carbon is harder than diamond, incredibly simple to make | ExtremeTech". ExtremeTech.
[7] "Researchers Find New Phase of Carbon, Make Diamond at Room Temperature". news.ncsu.edu. Retrieved 2016-07-08.
[8] Crowell, Maddy (2015-12-03). "A replacement for diamonds? Scientists discover Q-carbon". Christian Science Monitor. ISSN 0882-7729.



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