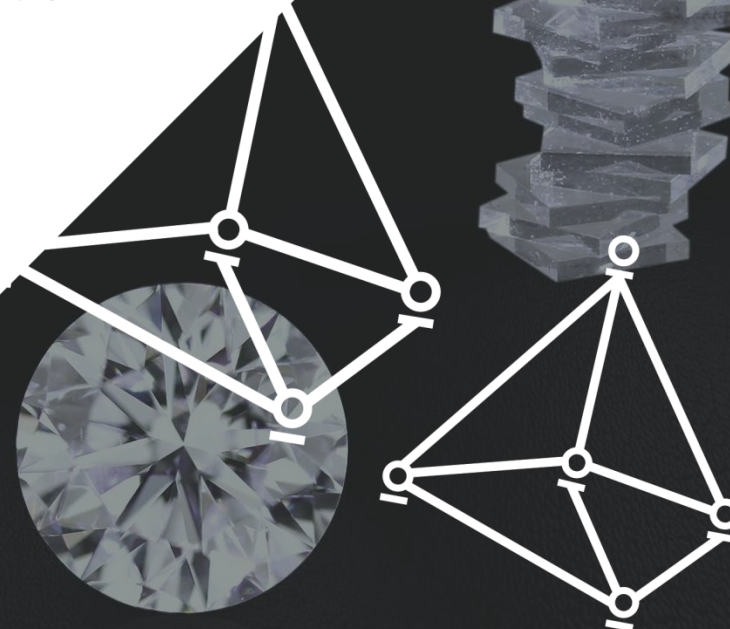
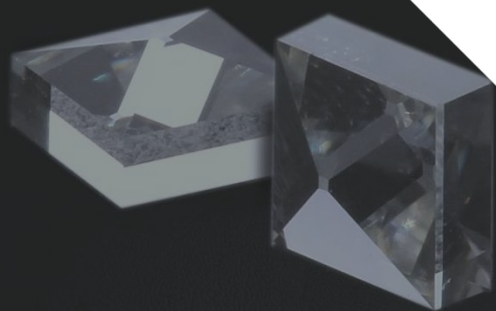




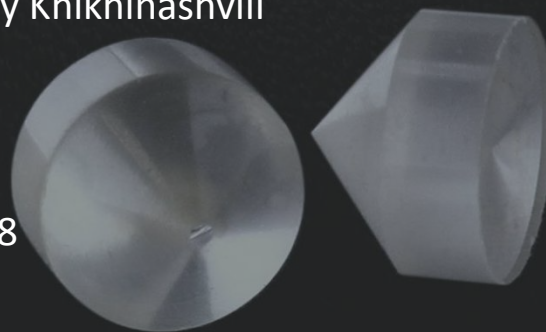
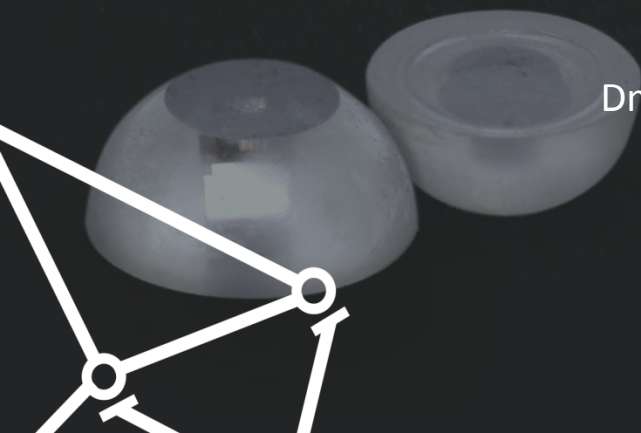
**NEW DIAMOND**  
TECHNOLOGY



**ADAMAS 2018**

Dmitry Semchenko, Nikolay Khikhinashvili

Vienna, 2018





**NEW DIAMOND**  
TECHNOLOGY

## Company description



- **Established:** 2014
- **Location:** Saint Petersburg, Russia
- **President:** Tamazi Khikhashvili
- **Number of employees:** 135
- **Sectors:**
  - Jewelry
  - Industrial & Hi-Tech
  - Scientific

New Diamond Technology company was founded for growing the largest high-quality single-crystal diamonds of IIa and IIb types. We actively develop Jewelry, Industrial and Scientific international market sectors and explore innovative approaches and technologies to improve quality of our diamond products. The company is focused on building partnerships with international research institutes and organizations to create mutually-beneficial collaboration with the main purpose - to contribute the whole diamond market.

The manufacturing facilities are equipped with the most modern presses improved in-house by our engineers and technologists. They developed unique technology of diamond growth which allowed us to set several world-records in the field of diamond growth and treatment. No one could beat these records to this day and we are annually aiming for more by increasing achievements constantly.



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Our products



SC Diamond plates



Diamond anvils



SF Diamond anvils



Diamond lenses

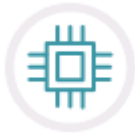


Polished diamonds



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## Market areas



- Micro and power electronics;
- Optics & Lasers;
- Detectors and sensors;
- X-ray and medical equipment;
- Quantum computers and photonics;
- CVD process;
- Jewelry.



## Synthetic diamonds production technologies:

HPHT (High Pressure High Temperature) and CVD (Chemical Vapor Deposition) are fundamental methods of diamonds growth.

### HPHT

- Spontaneous synthesis of diamond single crystals and powders;
- **Controlled synthesis of diamond single crystals on a seed\***;
- Synthesis of polycrystalline diamond by sintering powders.

### CVD

- Synthesis of single-crystal diamonds on HPHT or CVD substrates;
- Synthesis of polycrystalline diamond on the substrate from other crystalline materials (polycrystalline diamond, silicon carbides or nitrides of various materials).

### Explosive synthesis

- Production of cluster polycrystalline (ultrafine) diamonds during the process of ammunition utilization;
- Production of detonation polycrystalline diamonds of micron range during the explosion of a TNT and RDX, metal catalysts and fine graphite mixture.

\*Applied Technology



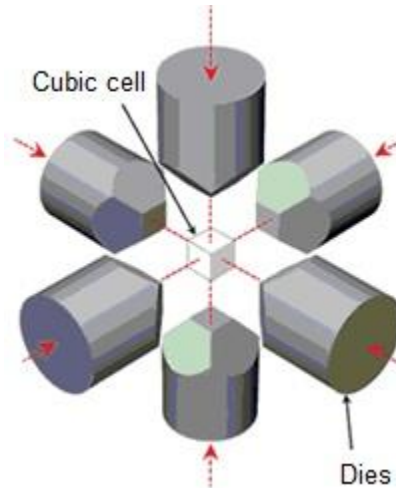
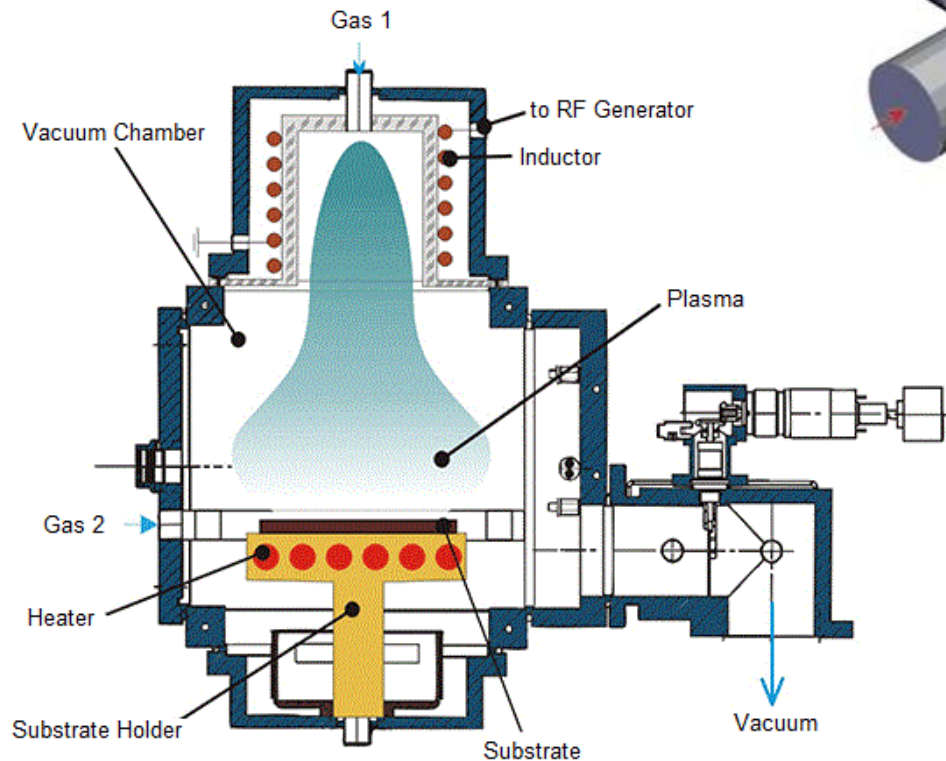
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Technology



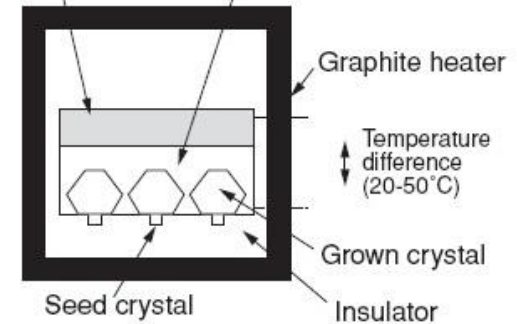
## HPHT

High Pressure High Temperature



High-purity  
carbon source

Solvent metal



## CVD

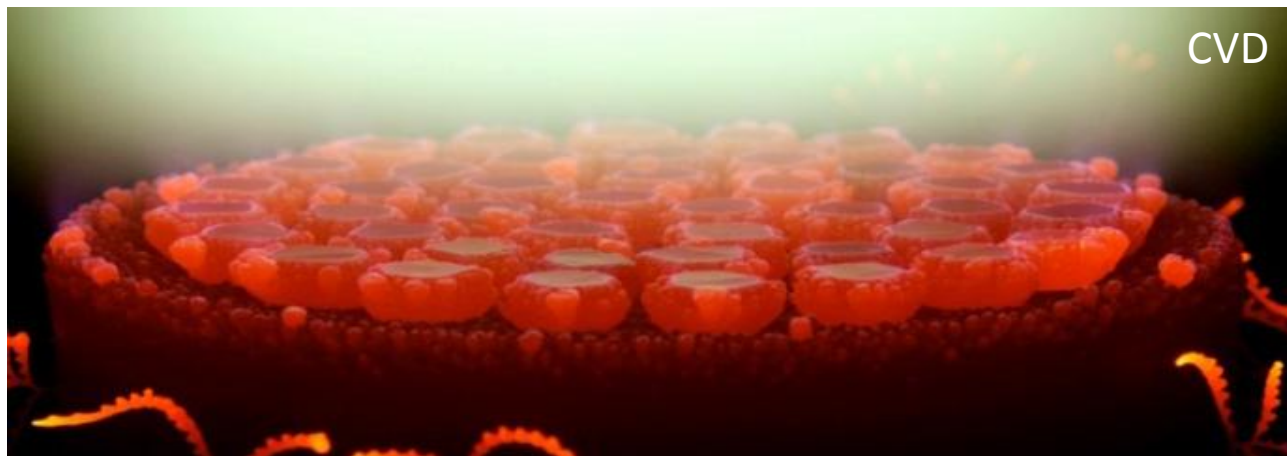
Chemical Vapor Deposition



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HPHT and CVD  
crystals

  
**CULTIVÉ**  
The Beginning of Something Beautiful





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## Rough diamonds



We grow the largest diamonds in the world of three types: colorless (IIa type), blue (IIb type) and yellow (Ib type). Rough diamonds can reach 100 Ct in size. Below you will find images of the largest IIa and IIb types rough diamonds grown by New Diamond Technology which were used to produce world-record polished diamonds: the biggest colorless and fancy deep blue polished diamonds.





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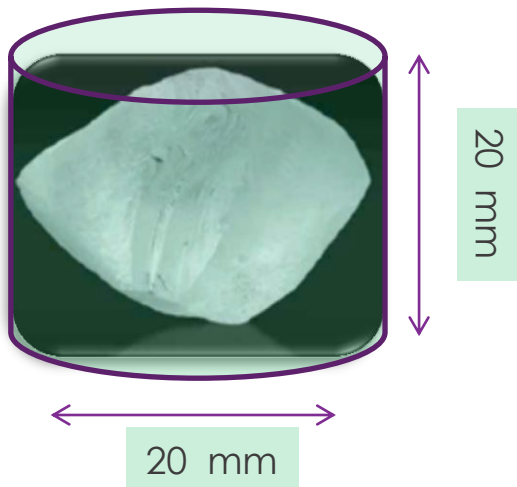
Large crystals  
development



Ultra-large single-crystal diamonds comparison: twice bigger by weight and volume,  
but only additional 5 mm needed in size

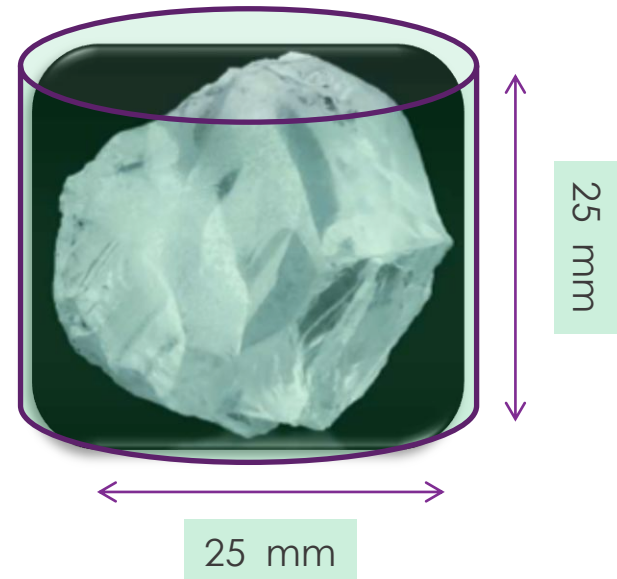
≈ **100** carat

≈ 6 cm<sup>3</sup>



≈ **200** carat

≈ 12 cm<sup>3</sup>



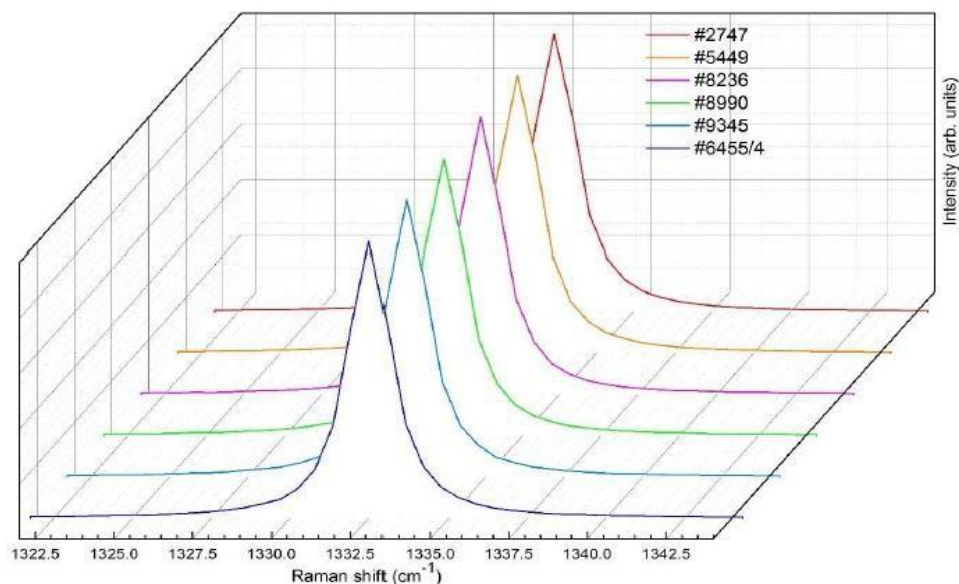


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Diamond  
quality



The line width (1332.5 cm<sup>-1</sup> FWHM) of high-quality single crystal diamond ranges between 1.70 - 1.80 cm<sup>-1</sup>. It can be seen that crystals stably come out the same quality. Coincidence of the positions of the maxima and the half-width of the line, with an average line width of 1.67 cm<sup>-1</sup>, which leads to the conclusion that research samples (6 pieces of different sizes and different production time) are **characterized by a high crystal-clear perfection, stable quality and low level of uncontrollable impurities.**



No	Raman (cm <sup>-1</sup> )	Δ (cm <sup>-1</sup> )
2747	1332.5	1.678
5449	1332.5	1.680
6455/4	1332.5	1.674
8236	1332.5	1.653
8990	1332.5	1.691
9345	1332.5	1.675

First order Raman



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## Plates specification



	Standard	Upon special request
Size, mm	3.0 x 3.0 – 12.0 x 12.0	Up to 15.0 x 15.0
Thickness, mm	0.5	0.1 – 3.00
Type	IIa	Ib, IIb
Face surface orientation	(100)	(111), (110), (113)
Side surfaces orientation	(110)	(100)
Crystallography	Multi-sectorial	Mono-sectorial
Dislocations density, cm <sup>-2</sup>	$\approx 10^{2-5}$	$\approx 10^{1-3}$
Roughness, nm	1.0 – 10.0	
Miscut	+/-3°	
Lateral Tolerance, mm	+ 0.2/- 0.0	
Thickness Tolerance, mm	+/- 0.05	
Boron concentration	$\approx 10$ ppb	Up to 50 ppm in (111)
Nitrogen concentration	$\approx 10$ ppb	Up to 100 ppm in (111)

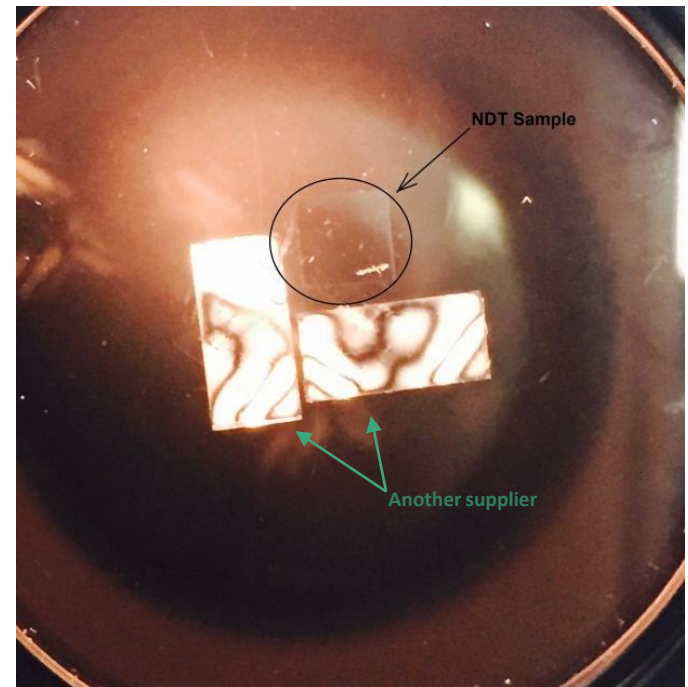
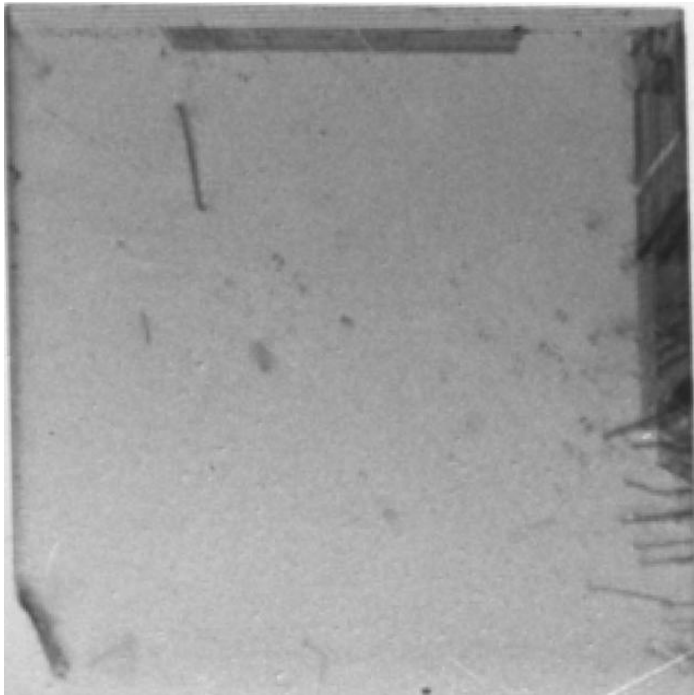


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Plates quality



Topography pictures of single-crystal diamond plates made by independent research group from France shows low dislocations density, no strain and minimum of bulk-defects:



New Diamond Technology guarantees free replacements for each off-type production.



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15 x 15 plate



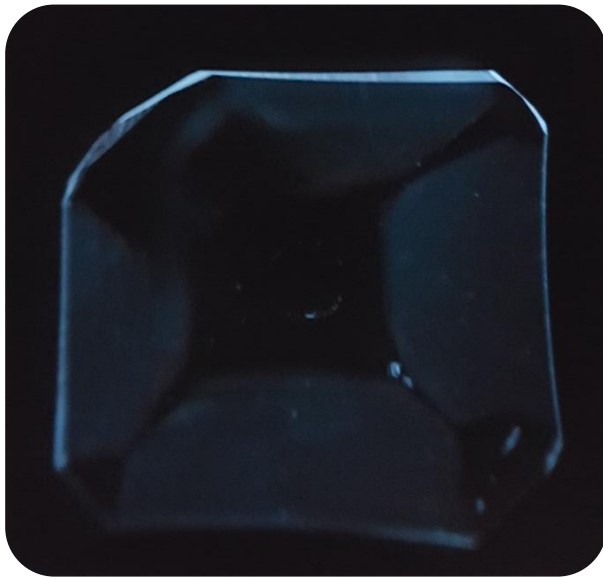
New Diamond Technology had produced the largest type IIa multi-sectorial HPHT SCDP with the ½ inch size: 15.82 x 14.69 x 1.0 mm



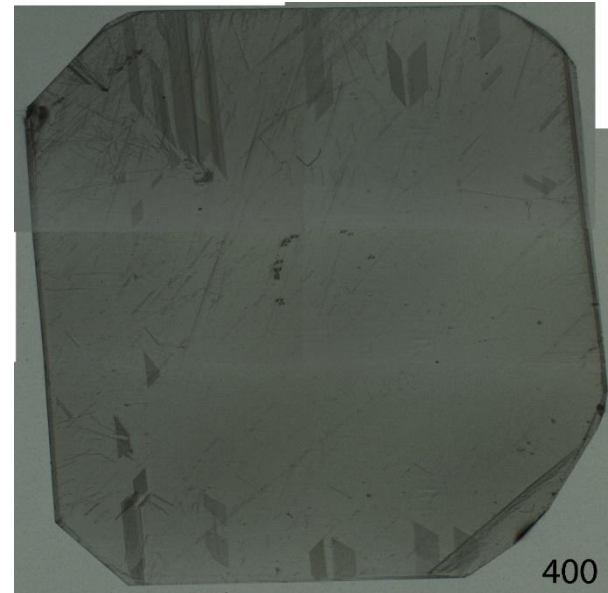


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15 x 15 plate



UV high-frequency image (IAF RAS)



White beam topography image (ESRF)



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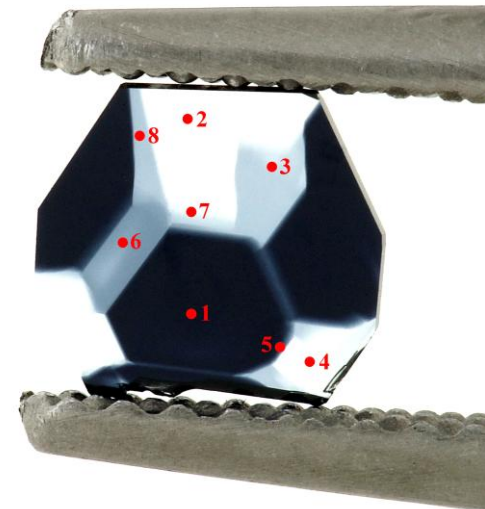
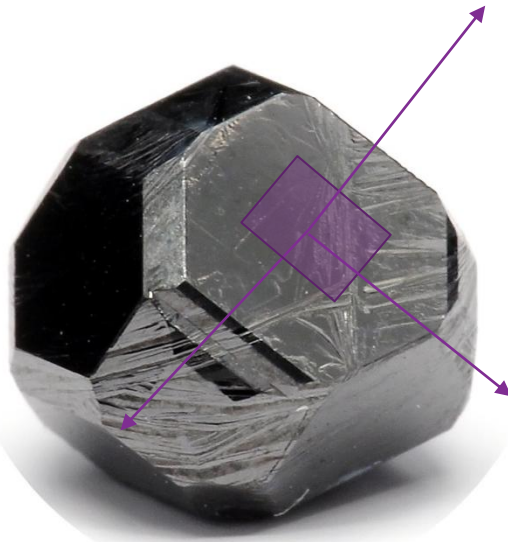
## Boron and Nitrogen doping



Since 2017 we produce highly Boron-doped SCD plates. Semi-conductive plates are cut from (111) sectors as this sector is most active for capturing Boron impurities. For the moment we are able to achieve 50 ppm concentrations.

Concentration of Boron (B uncompensated):

- Point 1 - 50.0 ppm
- Point 8 - 8.0 ppm
- Point 2 - 0.2 ppm





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World records



In the end of 2016 were presented the largest lab-grown polished diamonds to show the company facilities:

- The largest colorless fantasy shape diamond (15.32 Ct, G color, SI2 clarity);
- The largest colorless round shape diamond (6.07 Ct, G color, VVS1 clarity).



**NEW DIAMOND**  
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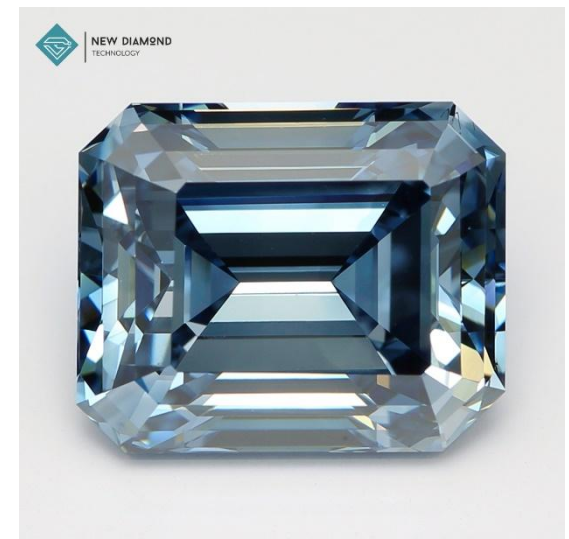
World records



New Diamond Technology has set several world records in grown diamond market:

- 10.02 Ct, E color, VS1 clarity - the largest colorless grown diamond in the world.
- 10.07 Ct, Fancy Deep Blue color, SI1 clarity - the world's largest blue grown diamond.
- 10.07 Ct, Fancy Intense Yellow, SI1 clarity - the world's largest yellow grown diamond.

All diamonds have been grown and polished by specialists and on the territory of New Diamond Technology.  
For more information visit [GIA website](#)





**NEW DIAMOND**  
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World records



New Diamond Technology is the only one company in the world which is able to produce pure and saturated Fancy Blue colors in 5 Ct+ size and 100 % mimic the color of the natural diamond. New collection of Fancy Blue diamonds is presented below:

- Oval shape, 5.52 Ct, Fancy Intense Blue, VVS2 clarity;
- Radiant shape, 5.95 Ct, Fancy Intense Blue, VS2 clarity;
- Cushion shape, 7.51 Ct, Fancy Deep Blue, VVS1 clarity;
- Cushion shape, 9.02 Ct, Fancy Deep Blue, VS2 clarity.





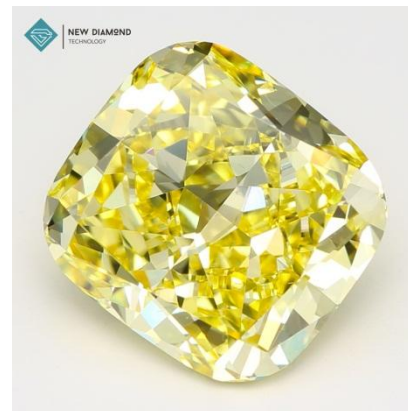
**NEW DIAMOND**  
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World records



In 2017 we started production of new collection of polished diamonds: orange pink and yellow intense colors. First testing collection is presented below:

- Pear shape, 0.73 Ct, Fancy Intense Orange Pink, VS1 clarity;
- Cushion shape, 2.04 Ct, Fancy Intense Orange Pink, SI2 clarity;
- Cushion shape, 3.70 Ct, Fancy Intense Yellow, VVS2 clarity;
- Cushion shape, 4.04 Ct, Fancy Intense Yellow, VS2 clarity.





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## Partners and projects



- In the end of 2015 New Diamond Technology became an initial founder member of **International Grown Diamonds Association**. This association is aiming to protect interests of grown-diamond producers, to raise global awareness of advantages and opportunities of grown diamonds and to bring the entire industry to a whole new level.
- Since 2016 New Diamond Technology is one of the main suppliers for the largest European project for micro- and power electronic devices **Green Diamond Project**.
- Since 2016 we are sponsors of one of the most respective diamond, carbon, silicon and other materials conferences MRS Fall Meeting & Exhibit 2016 in Boston, USA.
- Since 2016, New Diamond Technology established partnership with one of the largest jewelry companies in the USA – Stuller Inc.





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Partners and  
projects



New Diamond Technology actively supports the activities of the major research centers, laboratories, universities and institutions all over the world involved in development of diamond technologies and industry in general.



**Massachusetts  
Institute of  
Technology**



**Fraunhofer**  
IAF



UNIVERSITY OF  
**OXFORD**



University of  
**Strathclyde  
Glasgow**



**Arizona State  
University**



University  
of Glasgow



MAX-PLANCK-GESellschaft



**서울대학교**  
SEOUL NATIONAL UNIVERSITY



**POCHAHO**



**ALROSA**





**NEW DIAMOND**  
TECHNOLOGY

Contact  
details



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