



GeniCore
Genius of the Core



You Tube



First on the market – fully controlled and “on-line” maintenance of the **Pulse Plasma Compaction (PPC)** system.
High costs effectiveness through **high energy efficiency and sintering** repeatability in performance.
PPC as the breakthrough method allows to create new materials and markets
(e.g. Diamond Enhanced Cemented Carbide (DEC)).

www.genicore.pl



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PATENT »
PENDING

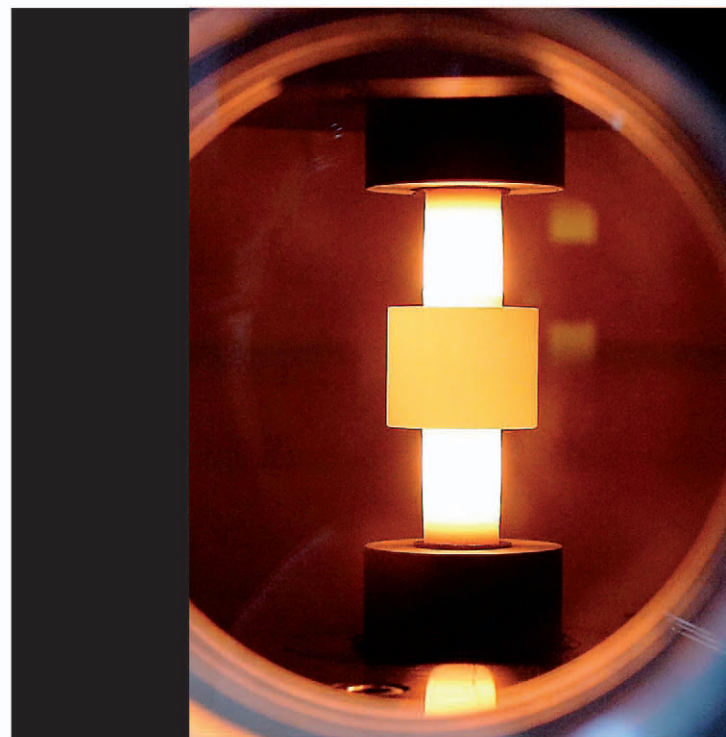
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PPC (Pulse Plasma Compaction)

is a universal and efficient way of powder consolidation. Its versatility provides a possibility to consolidate pure metal powders, metal alloys and ceramic and metal composites; especially in the **production of super-hard composite materials based on diamond – DEC**.

During the PPC process, electrical energy stored in the battery of capacitors is emitted in consolidated powder using electronic switch. The PPC is the **leading technology**, among others, of EPC methods, and is the only one which is **applied in industrial** scale because it solves the persistent problem of very poor durability of mechanical switches resulting in the erosion of the electrodes and the limited repetition rate of pulsed discharges.

► **Very long lifetime of an electronic switch means less downtime.**



Mass production or R&D system – **customized** for your application.
Complete solution – from your application idea through our **proof of concept** and **feasibility study** to the **mass production**.

The PPC technology of the GeniCore company

relates to the device used for the consolidation of powders by **high current** (the order of several dozen kA) generated by discharging of the battery of capacitors and a **high voltage** pulses repeated at **high frequency** of several dozen Hz, which allows for fast and precise temperature control in the process of consolidation of powder.

The use of capacitors as the source of energy ensures specific heating and cooling conditions, with this specificity lying in that the energy of several kJ is delivered to the powder being sintered within an **extremely short period of 0.2 ms**. During the flow of current, the powder is heated to a high temperature and, after the current flow vanishes, it is cooled to the specified sintering temperature very rapidly.

◀ **Extreme properties of the consolidated materials.**

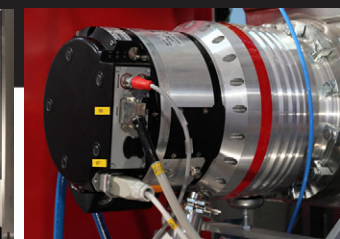
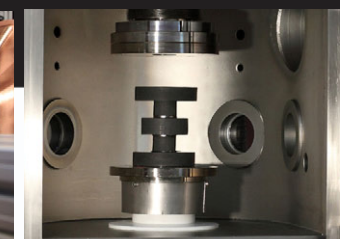
The PPC devices

are fully prepared for **industrial purposes** as well as for **research work**. They are equipped with systems of controlling the process parameters, which are collected by the central computer in the real time.

The fundamental advantages of this method, in particular for the production of **super-hard** composite materials based on **diamond**, are **short sintering** time and energy savings due to pulsed **energy delivery straight** to the sintered material, which prevents loss of energy for heating the whole vacuum chamber.

An important element in PPC devices, determining their faultless functioning, is electronic switch used to discharge of the battery of capacitors. The **PPC technology of the GeniCore company** thanks to the replacement of mechanical switch (thyatron, ignitron, vacuum or air switch) by electronic switch provides final user with the following advantages:

- radical improvement of switch durability,
- repeatability of current pulses,
- higher switch operation frequency (out of reach for vacuum and air gap switches),
- lower maintenance cost (no replacements of worn-out electrodes).





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Pulse Plasma Compaction

1. Vacuum – fast and effective vacuuming.
2. Pressing – precise and repeatability in performance.
3. Energy – controlled power and time.

Sintering unit includes the following main modules:

- Vacuum Chamber with pumping system and press frame,
- Hydraulic Unit,
- HV Power Supply,
- HV Capacitor Bank,
- HV Electronic Key.



Vacuum Chamber
is equipped with vacuum – voltage glands
together with electrically insulated slidable
punches and electric terminals.

Control hardware of PPC devices consists of:

- PLC controller, in which the control algorithms for sintering machine are implemented,
- Touch screen HMI system, which enables current operation of the device,
- PC for preparing recipes,
- IP camera that records sintering process taking place inside the chamber and archiving the data on the PC.

Chamber [mm]	550 x 555 x 500
Working pressure [mbar]	-5×10^{-3}
Pressure [kN]	200
Temperature [°C] *	0 – 2000
Z-Axis Stroke [mm]	250
Maximum discharge voltage [kV]	6
Maximum current in a pulse [kA]	60
Period duration [ms]	< 1

* Maximum temperature is limited by material composition,
die & punch dimensions and holding time.



User friendly software with an ergonomic workstation



► Everything is under control.

► Suitable for a range of shapes and sizes of the samples.

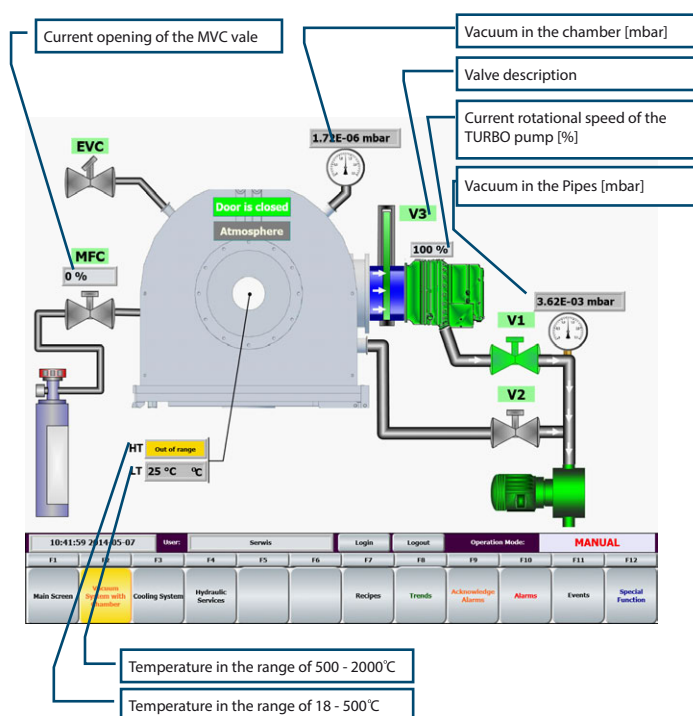


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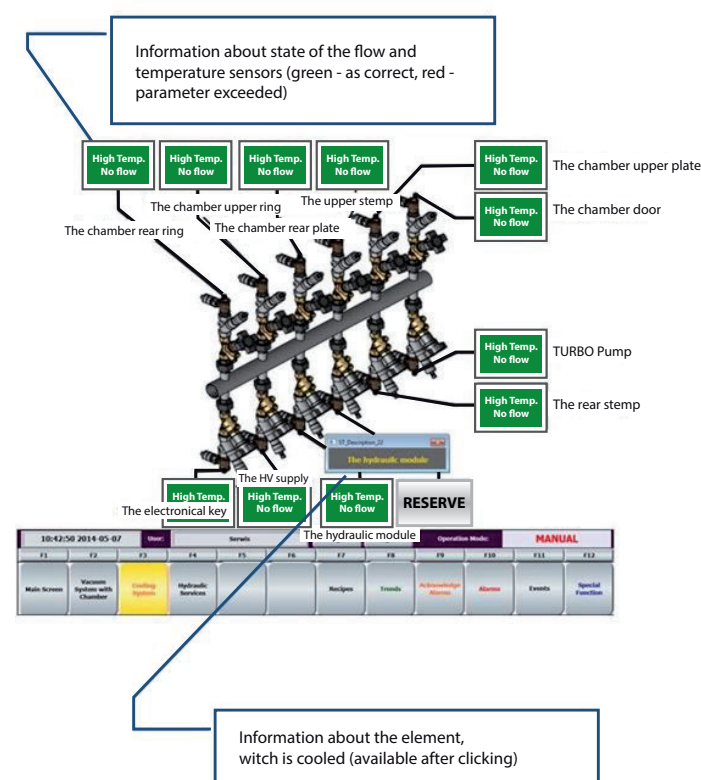
Application – see more at www.genicore.pl

Vacuum screen

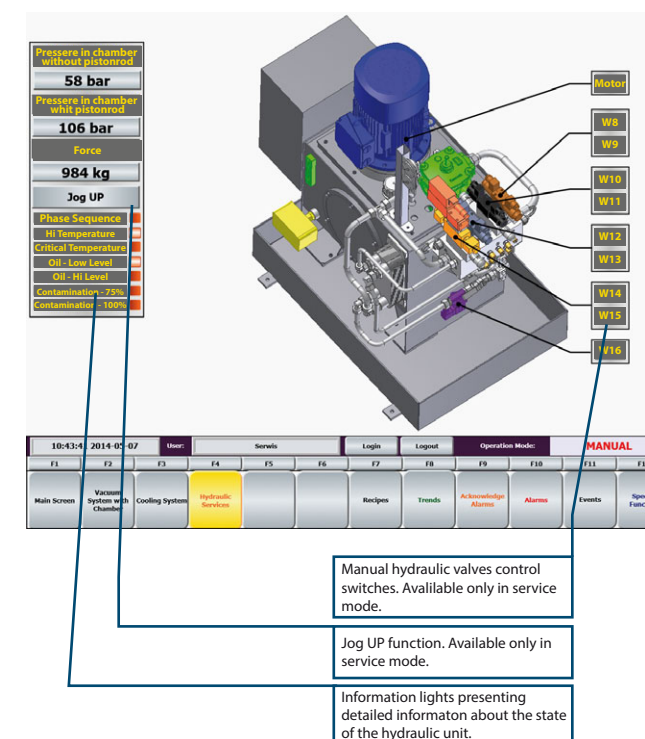
► Good communications and parameters database.



Cooling system screen



Hydraulic services screen



So far, **tools based on diamond** have undoubtedly revolutionized the tool industry by their significant increase in the efficiency of machining. One of the major challenges in this area is processing of materials using **very high cutting parameters**, with high quality of the machined surface. In this regard, ensuring a **long life time** of tools is very demanding.

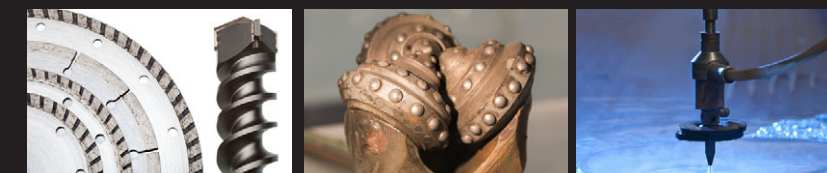
However, it should be noted that the use of low-melting alloys in diamond tools as the matrix, such as copper alloys with the addition of iron, nickel that are characterized by a much lower hardness than the diamond, leads to the fact that the wear of the matrix occurs much faster leading to the loss of diamond particles. Moreover, their properties are utilized only to some extent.

In order to achieve the **desired cutting performance for diamond tools**, special attention should be paid to the requirements set in terms of the matrix. Excessive wear level of the matrix shall lead to prematurely pulling the diamond particles, while too low wear leads to rounded sharp edges of the diamond. In addition, the matrix has to be characterized

by **high strength at high temperatures** and **resistance to dynamic load** in order to withstand the high temperature and vibration occurring in the cutting process.

A new group of sintered tools for processing of construction materials are **super-hard composite materials** based on diamond and cemented carbide matrix. The high hardness of the matrix made of cemented carbide can improve the **resistance to abrasive wear** of these tools and the **strong bonding of diamond** particles with the matrix.

Specific features appearing during the PPC process allow to fabricate a new, created by GeniCore, DEC material. It can be produced during the thermodynamic instability of the diamond, which is what renders this process technologically competitive, when compared with traditional sintering methods (which prohibit diamond sintering due to the graphitization process), and financially competitive, when confronted with HPHT technology of diamond sintering.



► Fully controlled system for the highest properties of sintered materials.



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