LEADING EDGE TECHNOLOGY

HiPIMS, the High-Power Impulse Magnetron Sputtering technology, is now 20 years old. Hauzer has been involved in developing this technology from the beginning, because we saw great potential. Today, the technology has reached industrial scale, with a reliable, stable process, so it can add value in many different types of applications in the tribo, tool and deco sectors.

APPLICATIONS WHERE HIPIMS REALLY SHINES

Valuable Properties of HiPIMS Coatings

One of the main benefits of HiPIMS technology is the coating smoothness and uniformity, even on complex shapes. Compared to conventional physical vapour deposition (PVD) processes, the unique feature of HiPIMS is its high ionisation, which allows users to control coating density and the coating distribution on sharp edges. This opens up new horizons in coating performance.
The Hauzer HiPIMS approach enables users to really tune the plasma process, by selecting and modifying a wide range of parameters in the recipe. In addition to changing parameters such as power, current, voltage, duty cycle, pulse on or pulse off time, users can reprogram the pulse sequence with the pulse

with modulation (PWM) mode, a feature unique to Hauzer. By changing pulse parameters and pulse sequences, Hauzer HiPIMS users can influence and tailor the coating’s properties for specific applications in terms of hardness, Young’s modulus and uniformity.

**Tool Application: Micro Tools**

Cutting tools that are smaller than 3 mm in cutting diameter are often called micro tools. These kinds of tools are used in, for instance, manufacturing watches and mobile phone components. One way to enhance the performance of micro tools is by changing the HiPIMS deposition parameters to influence the coating’s growth conditions and modulate its mechanical properties. The ratio between hardness and Young’s modulus (the H/E ratio) is often used to describe the ductility or brittleness of thin films. With Hauzer HiPIMS, compared to conventional sputtering technology, this ratio can be increased to reduce the brittleness while retaining the wear resistance.

For complex shapes, the H/E ratio is important to stabilise and reduce vibrations during the cutting process. This helps to protect the micro tool’s cutting edge. HiPIMS technology offers the possibility to grow a TiSiN film with a dense nanostructure, very good adhesion and an H/E ratio of 10.5, ideal for tools for materials that are difficult to machine. In the picture, the micro tool coated with HiPIMS TiSiN shows no delamination on the sharp cutting edges.
No Post-treatment Needed
The right coating can extend the life of high-precision micro tools, but the coating process itself is not without risk. Usage of conventional arc coatings, very common in the tool industry, can damage the filigree cutting edges and result in a rough surface. A post-treatment is mandatory for this kind of PVD deposition technology to smoothen the surface, but this can cause a fair amount of breakage.

HiPIMS coatings, in contrast, are smooth, nearly defect-free and uniform, with a reduced “antenna” effect on the cutting edge. The coating is consistently of good quality and requires no post-treatment for these kinds of tools. That means more tools will pass quality control.

Tool Application: New and Old Manufacturing Methods
HiPIMS also adds value to old manufacturing methods. The process of skiving to cut internal and external gears is experiencing a renaissance. The first patent on skiving was granted in 1910, and today’s production equipment can provide the high-precision synchronisation that is necessary for the skiving process. One disadvantage of skiving is insufficient tool lifetime – and here, HiPIMS technology can help. It can deposit a wear-resistant coating with very uniform distribution around the cutting edges, to significantly enhance the tool life and help establish skiving as a high-productivity technology.

Tribo Application: Smoother Surface for Tapping and Forming
For tribological applications where high hardness and a low friction coefficient are needed, a tetrahedral amorphous carbon (ta-C) diamond-like carbon (DLC) coating is a good candidate. Today, ta-C coatings made with Hauzer equipment are mostly deposited by Hauzer CARC+ technology. HiPIMS can help to achieve a smoother surface, which provides less torque, less friction and a longer component lifetime. If you routinely coat small parts that need post-treatment, the smoothness of HiPIMS will save you even more time and money.

In the tool industry, too, ta-C coatings are becoming very successful for tapping and forming of nonferrous materials such as aluminium, especially with a silicon content up 10%.

HIPIMS EQUIPMENT ON HAUZER MACHINES
Any new Hauzer machine can be configured with HiPIMS. And any Hauzer machine already in the field can be modified to include HiPIMS technology. The benefit of Hauzer equipment for HiPIMS is that we offer different chamber sizes, which can help keep the cost per part low by coating more items in a single batch. Although the running time goes up for larger systems, increasing the capacity more than compensates for that.

Hauzer is continually working towards even better performance of all our coating technologies, including HiPIMS. Interested to see what Hauzer can do for you? We always collaborate with our customers to see where we can enhance their specific coatings. We can also look into creating entirely new coatings, upgrading recipes with new additions, and boosting the performance of your coating architecture with multilayer or nanolayer structure.

Whether you are in tribo, deco or tool, contact: Philipp Immich (PImmich@ hauzer.nl or +31 77 355 97 80) to discuss how to boost your business with HiPIMS.