Nozzle in Protective Position

XPlanar Transports Workpiece during Plasma Surface Treatment Process

The XPlanar motor system combines the advantages of conventional transport systems with magnetic levitation technology. This opens up completely new possibilities for handling and positioning products in the machining process. The floating effect obviates the need for mechanical guiding components and helps Plasmatreat to simplify the system configuration for plasma treatment.

A floating planar mover carries the workpiece exactly into position for surface treatment

Fig. 1. The new plasma treatment unit is highly compact as it no longer requires a 6-axis robot or additional linear axes

Plasmatreat GmbH, a Steinhagen/Germany based manufacturer of plasma systems for high-efficiency surface treatment and environment-friendly production processes, unveiled a new plasma treatment unit at the K2019 trade show (**Fig. 1**). A key innovation is high-precision, flexible floating workpiece transport that replaces prior systems used to move often sensitive workpieces such as PCBs and eliminates the need to install complex 6-axis robots and linear motors. Instead the XPlanar motor system (manufacturer: Beckhoff Automation GmbH & Co. KG) is used. Like rotary motors, it consists of several stationary energized coils (tiles) and movable permanent magnets (movers). In contrast to rotary motors, both the coils and the permanent magnets are arranged in a plane. The tiles are the electrically active parts of the system: the current control of the coils contained in the system is orchestrated by a Beckhoff Industrial PC and allows the movers to float above the tiles.

The plasma treatment unit can surface-treat a variety of material samples in a two-stage process, as Jochen Stichling, Head of Design at Plasmatreat, explains (**Fig. 2**): "During the first stage, the substrate is moved under a nozzle for cleaning and activation. During the second, a separate nozzle applies a functional coating." This, he explains, is where the company focused its innovation efforts: "We wanted a fast, fully programmable, wear-free system to transport the workpieces, and that is what we have achieved with XPlanar."

Fig. 2. Jochen Stichling, Head of Design at Plasmatreat, values the custom-programming mover travel routes © Plasmatreat, Katrin Biller

Planar Motor System with Floating Movers

The system consists of tiles that can be arranged in any pattern, combined with contactless movers that float over them and can be positioned exceptionally fast, flexibly and precisely. The movers operate jerk-free and are capable of traveling at speeds of up to 2 m/s; they can also accelerate at 1g, and be positioned with a repeatability of 50 µm – silently, and without wear or abrasion. The system not only supports movement within the x-y space, it provides additional functions to allow movers to be positioned with up to six degrees of freedom when necessary (**Fig. 3**):

- Raising and lowering by up to 4 mm (unloaded),
- tilting by up to 5° when transporting and handling liquids,
- rotation up to 360°.

The XPlanar system in the Plasmatreat machine consists of six 240 x 240 mm planar tiles and a single planar mover.

A major advantage with XPlanar is that the plasma jets used to treat surfaces no longer need to be moved and, as a result, can now be installed in fixed mountings. The jets are complex, both mechanically and electrically, and the ability to move the workpieces rather than the plasma jets themselves reduces wear to the feed lines. For Jochen Stichling, there are additional benefits from the increased flexibility too: "We can attach a variety of material samples to the mover for treatment using just simple adapters. We can easily add processing stations alongside the plasma jets – markers for good parts, for instance, or optical sensing heads to conduct full part inspections – and carry workpieces to them flexibly as needed. And XPlanar's rapid acceleration also lets us move material samples at high speeds; with thin samples, for instance, this helps minimize treatment time with the fixed jet."

According to Stichling, the functional benefits of the system are proving valuable in a range of applications: "Conventional setups use a 6-axis robot or linear motors to move a plasma jet around a stationary workpiece. From a cost perspective, XPlanar comes in somewhere between linear-axis and robotic systems. With flat parts that don't require much vertical travel on the z-axis, where robotic systems are usually ideal, XPlanar offers an excellent alternative to gantry-type systems. XPlanar's advantages in terms of lack of wear, easy cleaning, and cleanroom compatibility also play out here."

Integrating Multiple Processing and Inspection Stations

For Stichling, XPlanar has the potential to optimize plasma surface treatment in two key areas, going forward: direct integration of in-line testing for full inspections during the treatment process, and custom-programmable mover travel routes for end customers. Another advantage for Plasmatreat was that it took less than two months to integrate the XPlanar system into its machine – not least because Beckhoff was quick to supply the 3D data and the electrical connection information that enabled the company to rapidly incorporate the XPlanar starter kit into its machine design. XPlanar, according to Jochen Stichling, has proved to be both robust and reliable. And another advantage, he points out, is that the entire plasma treatment cell has now been fully automated using PC-based control, making it a system solution from a single source. ■

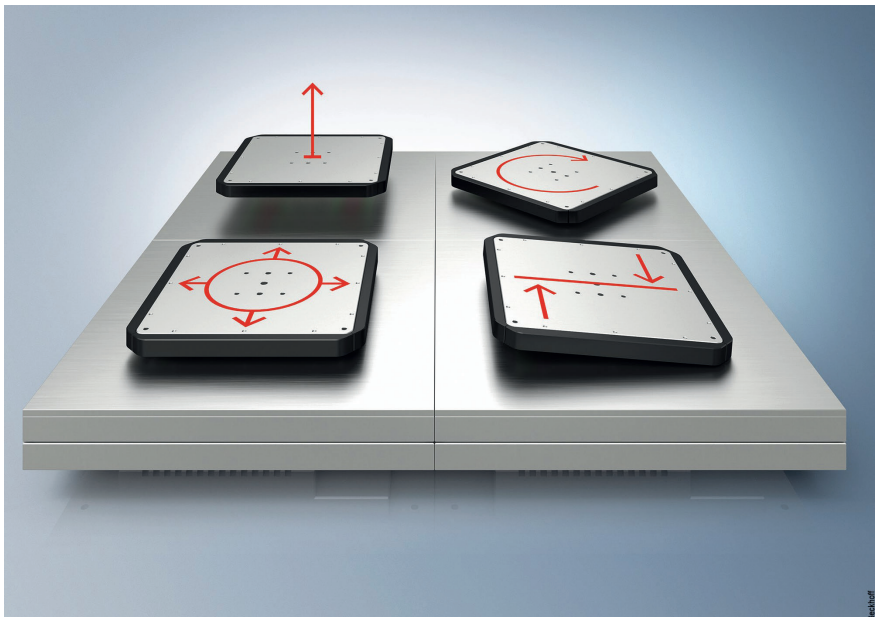

Fig. 3. An electromagnetic field causes the movers to float and guides them over the XPlanar system with maximum freedom © Beckhoff

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