Researchers break world record for drive systems

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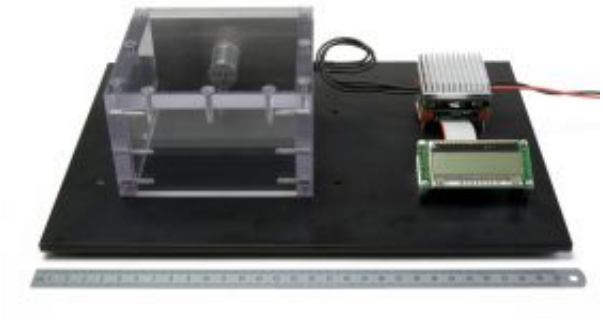

In future it can be expected that the drill used in material processing will become even faster and the compressor used for vehicles and airplanes even more compact. In order to drive these rotary applications directly, efficiently and in a controlled fashion, there must be electrical drive systems with the appropriate rpm and engine power.

Up to now, industrially-deployed motors have normally reached 250,000 revolutions per minute. Now, however, researchers from ETH Zurich's Department of Power Electronics have developed a drive system in cooperation with its industrial partners that can achieve over 1,000,000 rpm.

The new drive system generates an output of 100 watts and is barely bigger than a matchbox. The rotor construction has a titanium shell that is able to withstand extreme centrifugal forces and the ball bearings are optimized for extremely high speeds. Until now, it has been the case that the higher the rotational speed, the more losses there are. But the researchers from ETH Zurich have now managed to solve the problem with an especially low-loss stator.

Ultra-thin copper wire is used for the windings which are inserted in a cylinder made of special iron previously unused for machines. In addition, the machine is fed by electronics specifically designed for such engine speeds. "Our aim of breaking the million barrier was clear but the breakthrough was only possible thanks to the new technology," explains Christof Zwyssig, a post-graduate student from the De-partment of Power Electronics at ETH Zurich.

The drive system was brought to fruition in collaboration with industry. The ma-chine was manufactured by the German company, ATE GmbH, which specializes in the development of highly efficient electrical drives. The ball bearings came from the company, myonic, which is also based in Germany and has been manufacturing high precision miniature ball bearings for over 70 years. The construction of the whole system, the development of the electronics and the regulation of the drive system, however, was developed at ETH Zurich's Department of Power Electronics.

Based upon the results of this research, Christof Zwyssig and Martin Bartholet, also a post-graduate in the same department, founded the spin-off company, Celeroton, in August 2008. It will make the lab partners industrially viable with a view to providing ultra-high revolution electrical drive systems for different branches of industry and areas of application. Celeroton is set to become a supplier for manufacturers of, for example, fast-spinning drill or milling machines. The trend towards

increasingly smaller cell phones and other electrical appliances means that increasingly smaller holes have to be drilled for the electronics. This is only possible using a drive system that boasts a high rotational speed. "In my view, a spin-off company is the most direct way of transferring research results to industry. Our findings will rapidly be converted into concrete applications and products," explains Johann Kolar, Head of the Department of Power Electronics.

Source: ETH Zurich