New Material for Underwater Compressor

The exploitation of deep-sea natural gas deposits has been a very complex and expensive endeavor up until now. That's because this fossil raw material has to be processed on the surface, on land or on platforms. Researchers are therefore working hard to develop new technologies that can be utilized directly on the ocean floor. Dr. Ralf Bode has made a major contribution here with an invention that enables the hermetic sealing of a compressor with gasket-free integration of the compressor's electric drive.

For many years, Siemens has been conducting research into technologies that can withstand extreme deep-sea conditions. Companies that drill for large gas deposits generally install platforms on the open sea or else send state-of-the-art ships out to process the fuel after it's been extracted. Both of these approaches are very expensive. "Every job and the associated equipment on the open sea costs an average of one million dollars per year," says Bode, a materials expert. Bode therefore made it his mission to find a material that could be used to hermetically seal a compressor's motor stator from the gas mixtures that need to be compressed. His invention makes it possible to use compressors up to a depth of 3,000 meters — and it offers benefits for gas drilling on land as well. That's because the prototype, which is known as STC-ECO and is already operating at a Dutch gas field, works without gaskets, lubricant systems or gears. "Gaskets often need to be repaired," says Bode. That why compressors that are virtually maintenance-free make a major contribution to the cost-effectiveness of gas drilling and processing operations. Such compressors can also be employed when toxic, explosive or environmentally damaging materials have to be safely compressed.

Repairs can't be carried out underwater at all — but underwater repairs aren't necessary with STC-ECO. The machine is powered by a high-speed induction motor whose rotor is cooled with the gas mixture that's pumped in. However, this mixture may not come into contact with the motor stator's copper winding, since this would cause the copper to corrode very quickly. Bode's task was to find a material for the tube in which the electric motor's shaft rotates.

His solution was a modern fiber composite that had never before been used in such a manner. The material — made of glass fiber and epoxy resin — was manufactured in accordance with Bode's instructions by a company specializing in the production of materials for high-voltage switchgear. The fiber composite tube separates and insulates the stator winding from the gas mixture. This tube is robust, anti-magnetic, and resistant to any and all damaging effects from the gas.

Bode studied mechanical engineering at Ruhr-Universität Bochum and specialized in materials science. He received a Ph.D. in the latter discipline at the university's Materials Institute. Bode has been working at Siemens Energy's Oil and Gas Division in Duisburg since 2001. During this time he has registered 34 inventions that are now protected in 22 trademark families and 36 individual patents. Bode is a big music fan and often goes to concerts in his free time. "I like classical music, but I also enjoy going to jazz and rock concerts," he says.