Power without the cord

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With the aid of magnetic coupling, power can be transmitted wirelessly from a transmitter to a receiver module. The prototype with the transmitter can be attached to the belt. Credit: Fraunhofer IKTS

Cell phones and flashlights operate by battery without trouble. Yet because of the limited lifespan, battery power is not a feasible option for many applications in the fi elds of medicine or test engineering, such as implants or probes. Researchers have now developed a process that supplies these systems with power and without the power cord.

For more than 50 years, pacemakers have set the rhythm for many hearts. The engineering of microelectronic implants has since advanced by leaps and bounds: they have become ever-smaller and more technologically sophisticated. The trend is moving toward miniaturized,

intelligent systems that will take over therapeutic and diagnostic functions. For example, in the future implantable sensors will measure glucose levels, blood pressure or the oxygen saturation of tumorous tissue, transmitting patient data via telemetry. Meanwhile, medication dosing systems and infusion pumps will be able to deliver a targeted release of pharmaceutical substances in the body, alleviating side effects in the process.

All these solutions are composed of probes, actuators, signal processing units and electronic controls – and therein lies the problem, too: they must have a power supply. Batteries are usually ruled out because of their limited durability – after all, implants stay inside the body for years. Currently, radio wave-based (HF) and inductive systems are most commonly in use. However, these exhibit differences in efficiency based on location, position and movement and are also often limited in range. Soon, a new power transfer system should circumvent the limitations of previous methods. Researchers at the Fraunhofer Institute for Ceramic Technologies and Systems IKTS in Hermsdorf succeeded in wirelessly transmitting power from a portable transmitter module to a mobile generator module – the receiver. “The cylindrical shaped transfer module is so small and compact that it can be attached to a belt,” says Dr. Holger Lausch, scientist at IKTS. The transmitter provides an electric current of over 100 milliwatts and has a range of about 50 centimeters. As a result, the receiver can be placed almost anywhere in the body. “With our portable device, we can remotely supply power to implants, medication dosing systems and other medical applications without touching them – such as ingestible endoscopic capsules that migrate through the gastrointestinal tract and transmit images of the body‘s inside to the outside,” says Lausch. The generator module can be traced any time – regardless of power transfer – with respect to its position and location. So if the generator is located inside a video endoscopy capsule, the images produced can be assigned to specific intestinal regions. If it is placed inside a dosing capsule, then the active

ingredient in the medication can be released in a targeted manner.

How does this new, already patented system work? In the transfer module, a rotating magnet driven by an EC motor generates a magnetic rotary field. A magnetic pellet in the receiver connects to the alternating exterior magnetic field and as a result, is set in rotation itself. The rotational movement is transformed into electricity, thus the power is produced right in the generator module. “With magnetic coupling, power can be transported through all non-magnetic materials, such as biological tissue, bones, organs, water, plastic or even a variety of metals. Moreover, the magnetic field produced has no harmful side effects on humans. It doesn‘t even heat up tissue,” says Lausch, highlighting the advantages of the system.

Because the modules available as prototypes are scalable in terms of range, size and performance capacity, they can be used for more than medical technology applications. They can also supply power wirelessly to hermetically sealed sensors – such as those inside walls or bridges. This makes them suitable for use in mechanical engineering and plant construction and in the construction industry. Other conceivable applications include the charging of power storage units and activation of electronic components.

Using a hip implant as a demonstration tool, Lausch and his team will demonstrate how their wireless power transmission system functions at the Hannover Messe from April 23–27 (Hall 13, Booth C10). As used here, the technology electrically stimulates the ball-and-socket joint to stimulate the growth of cartilage and bone cells.

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