



Peltier systems

Thermoelectric cooling and temperature control

Peltier modules cool and control temperature without causing noise or vibration or requiring harmful refrigerants. Fraunhofer IPM develops and builds free-form modules that are optimally adapted to the geometry of the structures to be cooled.

Efficient and with no need for harmful refrigerants

Peltier modules pump heat entirely without harmful refrigerants and without moving parts. This means they operate reliably, without noise or vibration. They feature a compact design, short response times, high temperature resistance and a wide temperature range. This qualifies them for numerous applications in medical technology, in the consumer goods sector, and for special cooling applications in mechanical engineering and the catering business.

Substantial experience – from material to systems

Fraunhofer IPM draws on over 30 years of experience in material and module development for thermoelectric systems. We manufacture free-form modules in small batches on a partially automated module construction line and we are investigating novel concepts relating to assembly and connection technology. In our in-house measurement laboratories, we use custom-developed measuring devices to characterize the thermoelectric properties of materials and modules. This allows, for example, Peltier modules to be fully characterized under varying operation conditions at a dedicated Peltier measuring setup and a detailed data sheet to be derived from the data acquired.

From prototype to implementation

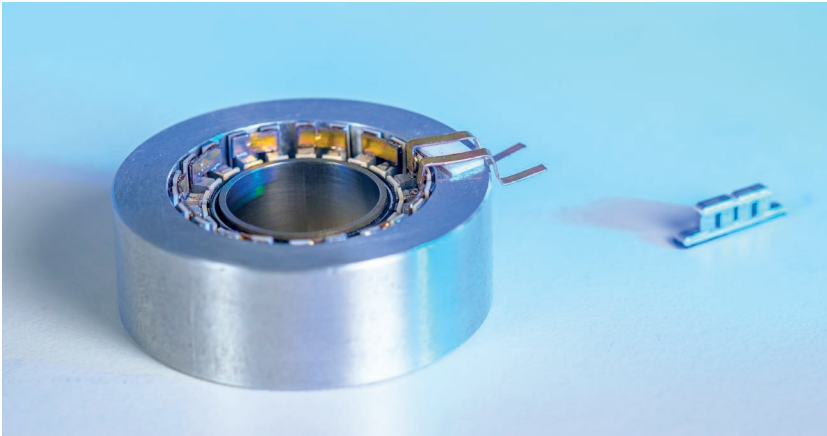
In order to make optimum use of Peltier modules, thermal coupling and the system design are crucial. We develop, build and characterize specific system solutions for our customers – from prototype to implementation.

Peltier systems developed by Fraunhofer IPM, such as a thermoelectrically cooled Gastro-norm (GN) trolley, thermoelectric surface coolers, or tubular Peltier modules for the dynamic control of high-load actuators, demonstrate the advantages of Peltier technology compared to conventional temperature control systems.

Our offer

We develop custom-tailored Peltier measuring and systems technology and characterize modules on behalf of our customers.

- Characterization of Peltier modules and creation of data sheets
- Development of measurement setups for modules and systems
- Long-term measurements in different environments
- Simulation and development of thermoelectric systems for Peltier cooling



The tubular Peltier module (left), developed by Fraunhofer IPM, is ideal for dynamic temperature control of round structures. A specially manufactured thermoelectric strip, one of 22 installed in the Peltier module, is shown on the right.

Tubular Peltier modules

Peltier modules are traditionally characterized by their planar design. Adapting these modules for the temperature control of cylindrical structures, such as pipes or shafts, results in complex, inefficient, and expensive component geometries and systems. To achieve optimum thermal and mechanical coupling, Fraunhofer IPM has developed a new method of reliably connecting thermoelectric modules to round structures. The ring-shaped modules are optimally adapted to the geometry of the structures being cooled, either by shrinking the surrounding structures or by expanding the inner structures during the pressing process. To this end, Fraunhofer IPM developed and manufactured thermoelectric strips suitable for installation in round structures.

Precise temperature control of round structures

The tubular Peltier module was originally developed for the dynamic temperature control of a high-load actuator made of a thermal shape memory alloy (SMA). The Peltier module heats and cools the internal FGL component. The outer ring, which is made of aluminum, serves as a heat sink or source. The actuator can either be solid, as in the case of installation in machine tools, or it can be designed with fins for convective heat exchange with the environment.

One pair of legs of the specially manufactured thermoelectric strips has a thermal pumping capacity of approx. 1.4 W in cooling mode. This corresponds to a total pumping capacity of over 30 W for the Peltier module. In heating mode, the Peltier module is significantly more powerful. The FGL component can be heated from 20 °C to 120 °C in just a few seconds.

Peltier modules have several advantages over other cooling or heating systems, including precise current-dependent temperature control, high dynamics, and a small system size.

Customized geometric adaptation

We design thermoelectric temperature control systems to precisely meet your requirements, equipping your systems with efficient, dynamic temperature control.

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