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WITg

WITg Fact-Sheet: Shape Memory Alloys drive a Solid State Heat Engine

Short profile and new approaches

One of the most effective mechanisms for converting thermal energy into mechanical energy is based on phase state changes. By means of shape memory alloys (SMAs), work can be performed by a nearly loss-free change of the lattice structure by a slight temperature change. Some of these so-called solid state heat engines were developed as demonstrators, e.g. the tilt plate heat engine of the HTWG Konstanz.

In a planned project the efficiency of a SMA-operated heat engine is to be significantly increased and thermal energy in a temperature range below or around 100 degrees Celsius is to be converted highly effectively into mechanical or electrical energy. For this the WITg is looking for potential industrial partners and/or public funding.

Energy in the low-temperature range in particular represents one of the greatest challenges to effective energy recovery and has so far only been used to a limited extent. The planned development will use shape memory materials to provide an extremely low-loss option for energy conversion that has hardly been used to date.
Since 1994, WITg and one of its two carriers - the HTWG Konstanz - have been working on the development and application of SMAs in actuators and, among other things, on the development of various thermal engines using these functional materials.
A tilt plate heat engine was developed in several projects, sponsored by the German federal states. Up to now a further development of this demonstrator into an industrial application was not possible due to a decisive disadvantage: the efficiency of this tilt plate heat engine was too low.

As a result, new drive principles were investigated and developed by WITg and HTWG in numerous non-publicly funded projects. These works led to a new patent for an optimized heat engine, e.g. with a controlled machine drive, a short-term prevention of the immediate resetting of the working elements after the transition from warm to cold range and an implementation of a travelling energy storage device.

These patent-protected improvements represent a promising concept for further development into an industrially usable thermal engine. However, due to the technological progress of the last years it is considered useful to explore the possibilities anew and to compare the existing concept with possible new concepts in order to find an optimal solution. By means of a systematic design and development phase, a first prototype is to be designed and set up in the WITg laboratory.

If you are interested in a joint research project, we are open to your ideas (our research projects are eligible for funding e.g. by Innosuisse).

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