

Introduction

The ‚Entropy Wheel‘ is an engine developed at the ITCP. We exploit the great potential of SMA (shape memory alloys) as actuators to gain mechanical energy by using small temperature differences. This will increase the efficiency of processes, which need to be cooled. In order to evaluate new ideas for optimisation and for adapting to our customer’s demands, we search for mentors and partners. Especially, we are looking for experts in cooling systems, for leaders with expertise as a product developer and with experience as a system integrator. We would enjoy the opportunity to offer new and interesting insights into many different aspects of our work by presenting our prototype. For detailed information please contact Prof. Dr. Manfred Wilhelm.

First Prototype Can Move a Car

We are proud to present an engine (vertical heat input) that can move a car. For the future e.g. we are evaluating a horizontal construction to further increase the power output.

power	15 W, mechanical at a temperature difference of 50°C
dimension	100 x 75 x 40 [cm] 30 kg
material	aluminium and stainless steel for the construction SMA for the 360 actuators/ springs
cooling	radiators with an air flow of 540 m ³ /h at ambient temperature
engine type	solid state heat engine non-pressure operation principle

Contact

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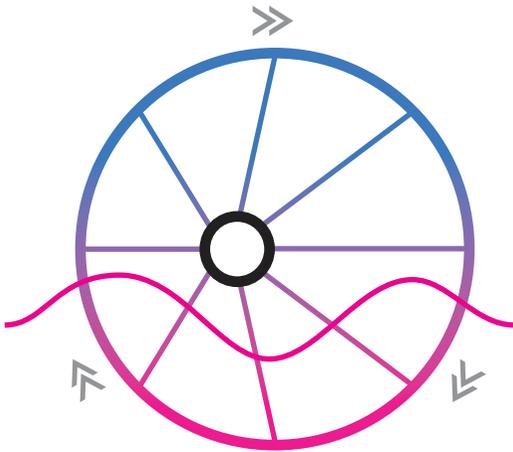
Entropy Wheel

Energy recovery of industrial waste
heat to increase the efficiency of
power plants and thermal processes

INSTITUTE FOR CHEMICAL TECHNOLOGY
AND POLYMER CHEMISTRY



Technical Aspects



Entropy Wheel - Working Principle

In the entropy wheel the transformation of thermal into mechanical energy takes place in spiral spring actuators made of shape memory alloys (SMA). The entropy wheel consists of two separately mounted wheels, which can be shifted eccentrically against each other: a bigger outer wheel and a smaller inner wheel (see illustration on the right). The shape memory actuators connect the two wheels like spokes, and contract when they are heated up. A temperature gradient across the entropy wheel results in a rotational movement providing a usable mechanical torque on the output shaft.

SMA as Actuator Material

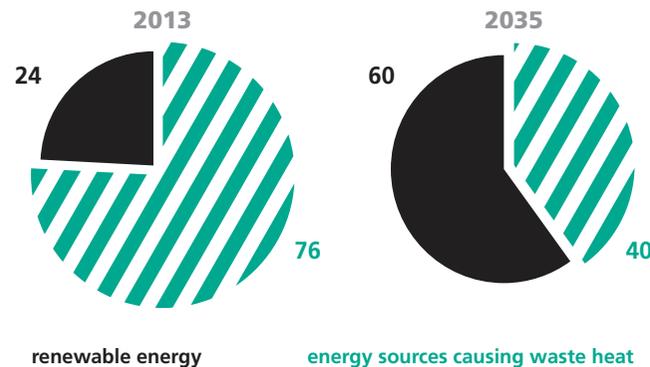
After testing different materials, we found out, that the best materials are shape memory alloys (SMA) on nickel titanium base. Actuators made out of these special metal alloys are very powerful at low volumes and weight. In addition, the heated springs contract which is a basic requirement for the material.

Economical Aspects

Hidden Market Potential

The energy turnaround promoted by the German Federal Government is a very popular discussion. Significant investments in projects are possible to generate innovations. Concepts which are offering a variety of possibilities to increase efficiency gain less attention. However, they are as well essential to realize sustainable economies. E.g. the production of energy causes a lot of unused waste heat. Though the nuclear power phase-out is decided and the investment volume for renewable energy is very high, energy recovery is a future market. In 2035 still 40% of the energy sources are still causing waste heat.

energy mix in Germany



source: Deutsche Bank Research



Our Network

Ingpuls GmbH and LWW, Universität Bochum

Our partner develops SMA on the basis of our individual needs and opens up new possibilities.

Institute of Product Engineering, KIT

The specialists for product development of the KIT enrich our interdisciplinary team.

Workshop of the ITCP

The institute's own workshop is able to realize our different concepts to increase the performance.

Institute of Technical Thermodynamic, KIT

This cooperation allows to evaluate the new horizontal prototype.

KIT Innovation Department

This service unit is supporting potential innovations, protecting them and initiating their commercial exploitation.

r2b-student e.V.

Our recruitment partner for interdisciplinary theses, internships and scientific assistantships to KIT students.