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THERMOS

Tellurium-Free Thermoelectric Modules by Interface Engineering

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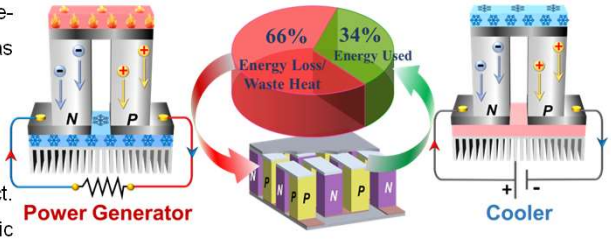
State of the art

Worldwide more than 60% of the generated primary energy is lost as waste heat. (Waste-)heat to electricity thermoelectric (TE) energy conversion, based on Seebeck effect, has several advantages in relation to traditional heat recovery technologies i.e.

- No moving parts
- Maintenance free
- Noiseless
- Compact
- Lighter and less bulky than ORC machines or steam turbines

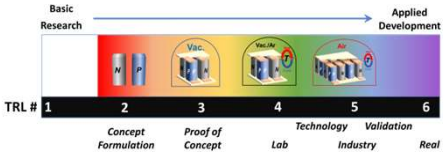
Moreover, TE modules can also be used for cooling down by using the Peltier effect. However, commercial Bi_2Te_3 modules display low efficiency (< 4 %), contain scarce and toxic elements (i.e. Tellurium), are expensive, and they are hand-made mainly in China or Russia.



Impact and potential benefits

THERMOS develops modules by material interface engineering and module encapsulation using innovative powder-Atomic Layer Deposition (pALD)

- usage of sustainable materials (non-toxic elements, low costs, large natural abundance)
- outperform and replace conventional Bi_2Te_3 modules
- enable new market opportunities
- foundations for patent application and production of a new generation of TE modules in Europe
- reach TRL 6
- support the partner SME Company TEGnology to enhance their portfolio of TE modules



Main objective:

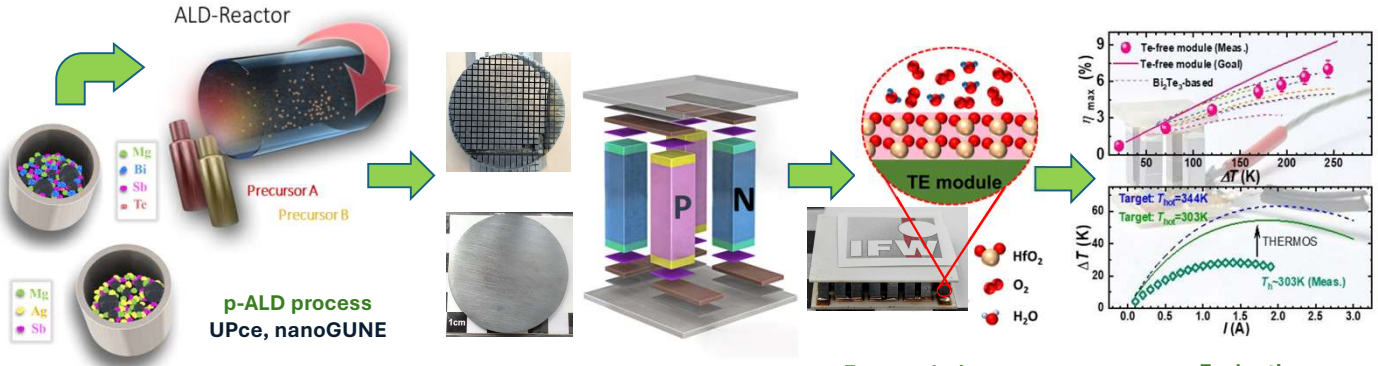
Development of highly efficient TE modules by interface engineering for entering into the growing markets:

- On-spot cooling
- Telecommunication
- Biomedical
- High-temperature sensors
- Internet of Things
- Waste heat recycling

Specific objectives

1. Conversion efficiency of > 8.5 %
2. Cooling effect of > 60°C in TE cooling.
3. Enhancing the reliability via ALD encapsulation. Minimum 5000 heating-cooling cycles.
4. Scaling up material synthesis (g to kg-scale), increase the number of n-p pairs in TE modules (n>16), production of series of TE modules (m=50).
5. Testing the TE modules in specific applications and environments (by an industrial partner) and evaluating the whole life cycle.

key findings and contribution of consortium partners



Powder Mg-based materials
IFW, IFAM

Demonstrator
IFW, IFAM

Encapsulation
nanoGUNE, IFW, Upce, TEGnology

Evaluation
IFW, IFAM, TEGnology

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