



## 2025 Helmholtz – OCPC – Program

for the involvement of postdocs in bilateral collaboration projects

### PART A

**Title of the project:**

Development of high-performance electrocaloric cooling device

**Helmholtz Centre and/or institute:**

Karlsruhe Institute of Technology (KIT), Institute of Microstructure Technology (IMT)

**Project leader:**

Dr. Jingyuan Xu

**Contact Information of Project Supervisor:** (Email, telephone)

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**Department:** (at the Helmholtz centre or Institute)

Institute of Microstructure Technology (IMT)

**Program Coordinator** (Email, telephone and telefax)

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**Description of the project (max. 1 page):**

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Cooling accounts for 17 % of total global electricity consumption. Vapor compression cooling dominated the markets, which uses refrigerants that can leak to the environment and exhibits low efficiency. By contrast, cooling based on an electric-field driven change in temperature of certain materials, i.e. the electrocaloric (EC) effect, promises an environmentally-friendly technology with high efficiency. However, three key obstacles have prevented EC cooling from becoming commercially relevant: small temperature span, low fatigue life, and high applied voltage.

This project has an ambitious goal of gaining insight into a regenerative EC cooler, which will enable the design and fabrication of the regenerative EC device exhibiting a large temperature span with long fatigue life. The project creates a new and robust, high-performance regenerative electrocaloric cooling device.

The candidate will be fully supported by our team and will benefit from the expertise of the group especially regarding material characterization technologies including tensile test, infrared thermography and differential scanning calorimetry, as well as prototype development. He/She will have access to state-of-the-art equipment at IMT including 600 m<sup>2</sup> clean room, rapid prototyping processes such as 3D printing and laser cutting, assembly and joining technology laboratories, various metrological laboratories.

The results of the candidate will allow a better understanding of the electrocaloric effect in EC materials and use them to develop cooling devices for cooling or heat pumping applications.

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**Description of existing or sought Chinese collaboration partner institute (max. half page):**

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N/A

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**Required qualification of the postdoc:**

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- PhD in mechanical engineering, electrical engineering or physics
- Experience with thermodynamics, heat transfer, materials science of electrocaloric materials
- Additional skills in mechanical design and micro technologies
- Language requirement: Fluent in English