

Topic 2:

Magnetic refrigeration based on rotating magnetocaloric effects

Supervisor:

Dr. Hu Zhang

Duration of the project:

2019. 5 -2019. 8

Abstract:

As the new field of magnetic refrigeration research, the “rotating magnetocaloric effect (RMCE)” will not only be much helpful to our theoretical understanding on magnetocaloric effect, but also provide new thoughts for the design of magnetic refrigeration materials and machines. However, since the research on RMCE has just started, the physical mechanism is still unclear and most studies are focused on the single crystals, which hinder the development and application of this novel technology. In our upfront work, we found for the first time that the textured polycrystalline DyNiSi and LaMn₂Si₂ compounds exhibit RMCE. Based on that, this project is proposed to study the RMCE based on magnetic anisotropy in oriented polycrystalline materials. The regulation mechanism on orientation will be investigated by different methods such as directional solidification and magnetic heat treatment. The physical mechanism of RMCE will be studied by combining theoretical and experimental methods. The RMCE will be enhanced by optimizing the composition and processing technique. Consequently, we expect to fully understand the physical and optimization mechanisms of RMCE, and obtain a material design method which could guide us to explore room temperature RMCE materials.

Preferable Candidates: Undergraduate Master Ph.D All

Required Skills/Knowledge:

Materials Science and Engineering, Physics, familiar with magnetism is favorable.

Reference Books/Papers:

[1] Tishin A M and Spichkin Y I 2003 in The Magnetocaloric Effect and its Applications, edited by Coey J M D, Tilley D R and Vij D R (Bristol: IOP Publishing).

[2] Tishin A M, Handbook of Magnetic Materials Vol.12, Amsterdam: North Holland, 1999.

[3] Gschneidner K A Jr, Pecharsky V K and Tsokol A O 2005 Rep. Prog. Phys. 68 1479.

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