Identification of magnetic anisotropy axes by means of the thermomagnetic Nernst effect

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The research focuses on the study of the thermomagnetic Nernst effect in selected soft magnetic materials. The Nernst effect links the electric field with the thermal gradient in conductors under the presence of an external magnetic field or spontaneous magnetization. Therefore, research activity is predominantly focused on thermoelectric generators exploiting ordinary or anomalous Nernst effect [1,2]. Other works reveal possible application as a spin-caloritronic devices [3,4], heat-flux meters or next generation energy harvesters [5,6]. An increased value of the Nernst coefficient due to presence a magnetic order of the sample has been presented in the papers [7,8].

The presented experimental research discusses and shows results of the influence of magnetic anisotropy of soft magnetic structures on the thermomagnetic Nernst effect. Contrary to existing works in this field, our approach concerns the application of the Nernst effect to identify and study the magnetic properties of the substrate in which this effect is observed. The effect was investigated in several samples made of high magnetic permeability Fe-containing alloys. The samples with 20x4x0.2mm were tested in a transverse arrangement, i.e. in which the magnetic field vector was applied transversely to the temperature gradient. The studies were performed for several values of temperature ranging from 293K to 320K.

The experimental results reveal a significant impact of structural and micromagnetic order on electric field potential caused by the presence of the Nernst effect. The linear relationship of the Nernst coefficient in the applied temperature range shows the feasibility of the effect as a tool for the identification of magnetic anisotropy axes using alternative, nonmagnetic techniques.

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