Разработанная модель конвективного теплообмена в секции прямого безокислительного пламенного нагрева агрегата непрерывного горячего цинкования позволяет определить коэффициенты теплоотдачи при непосредственном контакте потоков газа с поверхностью нагреваемой полосы и условия ее нагрева при различных режимах работы горелочных устройств, с учетом сортамента и режимов движения полосы, что дает возможность обеспечить повышение энергоэффективности нагрева в зоне.

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MAGNETOCALORIC EFFECT

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Some magnetic materials exhibit either an increase or decrease in their temperature when they are exposed to a certain magnetic field. This phenomenon is called the magnetocaloric effect or adiabatic temperature change [1]. For such a thermal response, the magnetocaloric material maximizes its temperature when it reaches the temperature of magnetic ordering. The magnetocaloric material is strongly limited by the temperature range in which the specific entropy density changes in response to the magnetic field. To achieve a larger temperature range, the MCE should be increased by adjusting the magnetic field strength (B), magnetic entropy transition (ΔSm), volumetric magnetization, magnetic field change (ΔB), Curie temperature (TC) of the magnetic material, magnetic phase transition properties, and crystallographic transformation.

Magnetic cooling technology has many advantages, which can be summarized as follows:

-Thanks to the use of magnetic materials as refrigerants, an environmentally friendly cooling technology is used, which does not produce ozone-depleting gases or greenhouse gases that pollute the environment.

-Magnetic materials have a higher magnetic entropy density than gas refrigerants.

-The MC can be equipped with electromagnets, superconductors or permanent magnets that do not need high rotational speeds, mechanical vibrations, noise, low stability or short service life for functional operation.

-The efficiency of magnetic refrigeration systems can be 30-60% of the efficiency of Carnot cycle [2], as opposed to 5-10% for conventional refrigeration technologies. Some results in the 5T magnetic field area can generate up to 600 watts of cooling power and 60% Carnot efficiency.

However, at the maximum temperature range, the cooling capacity drops to about 100 watts. In the 1.5 T magnetic field zone, MK systems provide a cooling capacity of about 200 watts.

There are several difficulties and challenges that limit the use of magnetic cooling in some applications. Among these problems are:

-there is a need for a magnetic material with a large MK;

-requires a strong magnetic field,

-excellent regeneration and heat transfer characteristics are required. Several researchers have investigated the main features of magnetic cooling cycles, the prospects of various models and the choice of magnetic material to achieve the highest efficiency.

Geisler Alloys

Studies of Ni2MnX Geisler alloys show that they have a number of unique properties. In them, such effects as the effect of magnetically controlled shape memory, the inverse magnetocaloric effect (FEM) [3], giant magnetoresistance are observed. All these effects are due to the structural phase transformation of the martensitic type occurring in alloys in most compositions at low temperatures. Ni2MnIn alloys attract attention due to their significant magnetocaloric effect. The structure of the high-temperature phase has L21 symmetry. The low-temperature phase is orthorhombic [4].

In contrast to the direct magnetocaloric effect, which is observed in conventional ferromagnets in the Curie point region, in the alloy of this system in the region of structural transformation, it has the opposite sign. Therefore, it is preferable to study this effect on alloys in which the temperatures of structural and magnetic phase transformations do not coincide. That is, the effects in the field of magnetic transformation and martensitic transformation occur at different characteristic temperatures, which differ by the maximum possible amount. In the literature, the magnetocaloric effect is associated with the influence of the magnetic field on the temperature of the structural phase transformation. Under the influence of the applied magnetic field, the austenitic phase is stabilized, in which the magnetization is greater than the martensitic phase.

This paper presents the results of the study of the influence of the magnetic field on the temperature of martensitic transformation and the study of the magnetocaloric effect in polycrystalline alloy Ni50,2Mn39,8In10.

Material and methods of research

A polycrystalline sample of the composition Ni50,2Mn39,8In10 was produced by arc melting in an argon atmosphere with several remelts from the metal powders of the alloy components in the nominal composition Ni46Mn41In13. The resulting ingot had the form of a «tablet» with a diameter of 20 mm and a height of 10 mm and, for the purpose of homogenization, was annealed in a vacuum furnace at a temperature of 900 ° C for 48 hours, followed by natural cooling in vacuum. Samples were cut out of this ingot by the method of electroerosion cutting for study. The elemental chemical composition of the sample was determined by energy dispersive X-ray spectroscopy (EDX) and amounted to Ni50,2Mn39,8In10 [5].

The characteristic temperatures of the structural and magnetic phase transitions were determined using a universal differential scanning calorimeter. The rate of temperature change of the test sample was about 5 K/min. The study of the temperature dependence of the electrical resistance was carried out using the 4-contact method. Contact wires are fixed to the ends of the sample in the form of a parallelepiped with dimensions of 7 mm × 1 mm × 1 mm by soldering.

To determine the magnitude of the magnetocaloric effect, the method of direct measurement of the adiabatic temperature change of the alloy sample was used when the magnetic field was turned on or off. Two plates measuring 6 mm × 6 mm × 1 mm were cut from the alloy ingot. One of the copper constantane thermocouples was placed between the plates. The end of the second thermocouple was attached through a small heat insulator. Then all this was isolated and placed in a tank, inside of which, with the help of an electrical resistance furnace and nitrogen vapors, the set temperature of the FE measurement was set. The X-input of the recorder was supplied with the value of the second thermocouple, which registers the real temperature of the sample. A potential difference was applied to the Y-input from the first and second thermocouples, which shows how different the temperature of the sample itself is from the adiabatically isolated system in which it is placed.

Conclusions

1. According to the results of studies of phase transformations by differential scanning calorimetry, the following phase transformation temperatures were established: MS = 296 K; MF = 287 K; AS = 297 K; AF = 308 K; TC = 325 K.
2. It is established that under the action of an applied magnetic field, the temperature of the structural transformation is shifted to the low temperature region. In a magnetic field with a strength of up to 1.55 MA/m, the transformation temperature decreases by 4.8 K.
3. In the field of magnetic transformation, a direct magnetocaloric effect is observed. Its magnitude in a magnetic field of 1.55 MA/m is $\Delta T = 1.4$ K. In the region of martensitic transformation, the reverse magnetocaloric effect is observed.In a magnetic field with a strength of 1.55 MA/m, it is equal to $\Delta T = 1.75$ K.

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OVERVIEW OF TYPES AND PARAMETERS OF GAS FLOW METERS USED IN AUTOMATED ENERGY ACCOUNTING SYSTEMS

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In modern automated systems for monitoring and accounting of energy resources and water, the main devices collecting data from consumers are water, electricity and gas meters. In order to develop a meter that surpasses the existing ones in its characteristics and ensure the competitiveness of systems using such meters, it is necessary to review the measuring devices available on the market. This paper collects data on natural gas meters.

Gas meter (gas meter) is a metering device designed to measure the amount (volume), less often – the mass of gas passed through the pipeline. The amount of gas is usually measured in cubic meters (m3), rarely in units of mass (this mainly concerns process gases).

Devices that allow measuring or calculating the passing amount of gas per unit of time (gas flow) are called flow meters or flow meters. Most often, gas consumption is measured in cubic meters per hour (m3/h).

Gas meters with slightly worse accuracy than conventional commercial meters, designed only for technological or on-farm accounting, are often called quantometers.

Gas meters differ in design, in their characteristics and functional purpose.

Main characteristics of counters:

Throughput is the range of expenses in which the meter measurement error declared by the manufacturer is provided.

According to the maximum throughput, gas meters are conditionally divided into household, municipal and industrial.

Household

With a maximum throughput from 1 to 6 m3/h. Most often used in apartments, houses, offices, small furnace rooms for local accounting of gas consumption. These are, as a rule, small membrane