Temperature Influence of the Functional Properties of Inductive Components with Metal Oxide Magnetic Cores

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Inductive coils and transformers are commonly used components in electronics. These elements are composed of a ferromagnetic core and windings. The most common material used for the cores of inductive components are ferrites. Ferrites are ceramic materials, whose main component is iron oxide (Fe₂O₃). Ferrites are produced by sintering a mixture of oxides: Fe₂O₃, MnO, NiO, MgO, CuO, ZnO, SrO, BaO. They are ferrimagnetic and electrically nonconductive materials. Ferrites have a higher resistance and much lower energy losses than metallic materials.

Main functional properties of the ferrite cores are inductance and power loss. The cores are often working in environmental conditions other than normal conditions. Especially temperature is very often differing from its normal value. These changes may come from heating of the elements during work or from changes in the ambient temperature. Changes of the value of inductance may affect the parameters of the electrical circuit. The increase of the value of power losses leads to higher energy consumption.

The paper presents the results of investigation on the influence of temperature on the inductance and power loss in the ferrite cores. Special measurement system composed of hysteresisgraph, cryostat and computer was utilized to perform the experiment. The cores used during the investigation had closed magnetic circuit. In order to perform measurements of magnetic properties of the material, two sets of windings (magnetizing and sensing) were made on each core. The cores were placed in a cryostat, which was used to set the temperature value within the range from -20 to +60°C. The magnetic properties were measured by the hysteresisgraph.

The obtained results confirmed the change in the value of inductance and power loss under the influence of temperature. These results should be taken into account in the design of electronic circuits containing such elements.