Under the influence of a high-gradient magnetic field, the concentration of magnetic particles in the gap increases significantly. With increasing concentration, the viscosity increases, which leads to a loss of fluidity in the liquid. This, in turn, can lead to problems in the MFS operation.
The aim of this work is to determine the influence of the pole piece geometry on the time at which the magnetic fluid loses its fluidity in the gap of the magnetic fluid seal.
The magnetic field is described by magnetostatic equations. The processes of diffusion and magnetorrhoesis are described by a transfer equation, where a concentration-dependent diffusion coefficient is used.
Based on the formula for viscosity concentration dependence, an expression for describing the relative mobility of particles is proposed. The problem is solved numerically using the control volume method on a triangular mesh.
The numerical calculations allowed us to obtain the distribution of the concentration and viscosity of the magnetic fluid under the polar pieces of different geometries.
The time during which the magnetic fluid loses its fluidity has been determined. Comparing the different geometries of the pole pieces shows that with a triangular geometry, this time is longer than with a rectangular geometry.

Influence of humidity on electrophysical properties and charge transfer mechanism of nanoscale DLC coatings

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The investigation of nanoscale diamond-like carbon (DLC) coatings on acrylonitrile butadiene styrene plastic substrates revealed a linear voltammetric characteristic, a decrease in resistivity from 12 Om•m to 3 Om•m, and a decline in wetting angle from 52° to 38° with increasing thickness from 54 nm to 71 nm. The relative permittivity of the DLC coatings takes values from the range of 5.6...6.5, and in the high frequency limit is completely determined by the real part. It is proposed to consider the conductivity in the system "DLC-coating//adsorbed layer of H_2O molecules" as a combination of two mechanisms: the hopping conductivity of electrons in the volume of the DLC-coating and the proton conductivity by the Grotthuss mechanism in the adsorption layer of water molecules. It has been experimentally established that the variation of air humidity in the range of 16% to 95% leads to a decrease in the resistance of the system up to 103 times. The results demonstrate the potential for developing a humidity sensor based on a DLC-coating with a thickness of approximately 50 nm. This technology will be applied in the fabrication of GEM-detectors with resistive coating of the collector electrode.

Computer simulations of the thermal stabilization system of the MPD detector of the NICA accelerator complex

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The NICA (Nuclotron-based Ion Collider Facility) accelerator complex of the Joint Institute for Nuclear Research (JINR, Dubna) is a new collider complex aimed at studying the properties of matter and the processes of collision and birth of new particles with subsequent detection and identification of the latter. Within the framework of NICA project, development is underway to create the MPD (Multi-Purpose Detector) facility for detecting high-energy beam collision products using the TPC (Time-projection chamber), ECal (Electromagnetic Calorimeters) and other subdetectors. During functioning of the MPD facility, heat generated by the detector electronics may lead to a deviation of the thermal stabilization of the working gas volume and, as a result, negatively affect the accuracy of event detection. To control heat generation on the TPC and ECal subdetectors, the MPD is equipped with a water cooling system for electronics and thermal stabilization of the TPC working gas volume. The report describes the design features of the MPD cooling system. The 3D finite element model of the cooling system was developed and numerical calculations of the coolant flow through it were performed. The results of the numerical experiment were verified using data obtained from a full-scale experiment on a specially designed stand.