Nikolay N. Grinchik, J Anal Bioanal Tech 2016, 7:5(Suppl)
http://dx.doi.org/10.4172/2155-9872.C1.025

Electrodynamics and Electrochemistry of Inhomogeneous (Laminated, Angular) Structures

Nikolay N. Grinchik
Heat and Mass Transfer Institute of the National Academy of Science, Belarus

The consistent physicomathematical model of propagation of an electromagnetic wave in a heterogeneous medium has been constructed using the generalized wave equation and the Dirichlet theorem. Twelve conditions at the interfaces of adjacent media were obtained and justified without using a surface charge and surface current in explicit form. The conditions are fulfilled automatically in each section of the heterogeneous medium and are conjugated, which made it possible to use through-counting schemes for calculations. For the first time the effect of concentration of "medium-frequency" waves with a length of the order of centimetre at the fractures and wedges of domains of size 1 - 3 μm has been established. Numerical calculations of the total electromagnetic energy on the wedges of domains were obtained. It is shown that the energy density in the region of wedges is maximum.

The results of these calculations are of special importance for medicine, in particular, when microwaves are used in the therapy of various diseases. For a small, on the average, permissible level of electromagnetic irradiation, the concentration, focus of electromagnetic energy in internal angular structures of a human body (cells, membranes, neurons, interlacements of vessels, etc) is possible.

We have constructed a consistent physicomathematical model of interaction of nonstationary electric and thermal fields in a layered medium with allowance for mass transfer. The model is based on the methods of thermodynamics and on the equations of an electromagnetic field and is formulated without explicit separation of the charge carriers and the charge of an electric double layer. We have obtained the relations for the electric-field strength and the temperature, which take into account the equality of the total currents and the energy fluxes, to describe the electric and thermal phenomena in layered media where the thickness of the electric double layer is small compared to the dimensions of the object under study with allowance for mass transfer.

We have modeled numerically the heating of an electrochemical cell with allowance for the influence of the electric double layer at the metal-electrolyte interface and mass transfer. The calculation results are in satisfactory agreement with experimental data.

Biography

Total years of work experience: researches, including investigations of transfer processes in porous media, electrolites, membranes, distributions of electromagnetic waves in inhomogeneius (laminated, angular) structures, development of mathematical and computational models. 1972-2003 – Junior and Seniour researcher at the A.V. Luikov Heat and Mass Transfer Institute, National Academy of Sciences of Belarus; 2003- at present time – Leading Researcher at A.V. Luikov Heat and Mass Transfer Institute, National Academy of Sciences of Belarus; 2005 - at present time – associate professor of Mathematical Physics Chair at Belarusian State University, Belarus. Study Course: 'Mechanics and electrodynamics of heterogeneous media'. Member of Belarusian Physics society. Member of Supreme Attestation Committee of Belarus from 2011. Academic awards and grants – Prizewinner of Koptug's Award of Siberian Branch of Russian Academy of Sciences (2013). Grinchik N. N. published more than 100 papers, has 40 inventions.

nngrin@yandex.ru

Notes: