Nanocomposites and nanomaterials

Continuum modeling of nanoelements

T.S. Nahirnyj[1], K.A. Tchervinka[2]

[1] *Centre of Mathematical Modeling, Pidstryhach Institute of Applied Problems of Mechanics and Mathematics of Ukrainian National Academy of Sciences, Dudaeva Street 15, Lviv-70005, Ukraine;*
Faculty of Mechanical Engineering, University of Zielona Góora, Ul. Prof. Szafrana 4, 65-516 Zielona Góra, Poland.
[2] *Department of Mathematical Modeling, Ivan Franko National University of Lviv, Universytetska Street 1, Lviv-79000 , Ukraine.*
E-mail: k.tchervinka@gmail.com

Using methods of nonequilibrium thermodynamics and nonlinear mechanics there is proposed an approach to description of the interconnected fields in nanoelements. The mass density is introduced into the space of state parameters along with parameters that are generally accepted in thermomechanics of solids; i.e. this space includes both the characteristics of fields and the properties of material.

The equation of mass balance is modified to describe structurally nonhomogeneous materials. It contains the mass sources associated with a method of forming the body surface. It is supposed that the structure of the body material has arose suddenly at the initial moment of time and doesn't changed afterward.

There are presented the boundary value problem formulations for nonlinear and linearized approximation and the solving methods are discussed.

Using the example of the model one-dimensional problems (thin film, fiber etc) the nearsurface nonhomogeneity of the interconnected fields is studied and it is shown that the models built within the approach allow describing various size effects including the ones of surface stresses, surface tension, strength, effective elasticity moduli etc., as well as multiscaling character of the effects.

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