

FROM NANOSCALE EFFECTS TO MACROSCOPIC QUANTITIES BEHAVIOR: EFFECTS OF ELECTRIC AND MAGNETIC FIELDS ON TWO-PHASE MEDIA

Author: Floriana - Daniela STOIAN

Abstract

This thesis presents the contributions to the main research themes that continued and developed from my PhD studies, starting 1998. These main research themes are: (i) study of the liquid – vapour phase transition control by electric fields and (ii) magnetic nanofluids: heat transfer control by magnetic fields and thermal properties.

The first theme was approached in 1999, with the aim of understanding the basics of phase-change phenomena at nanoscale and how manifest at macroscopic scale in change of measurable quantities. In order to accomplish these goals, I used molecular dynamics method to study the near-critical point phase transition in either two-dimensional or three-dimensional systems, of hundreds up to one thousand molecules, interacting via Lennard – Jones potential. The study was extended to the effects of external electric fields on the structure and thermodynamic properties of these molecular systems. The results of this study matched the macroscopic observations of the electric field effect on the liquid – vapor phase transition in microgravity.

The second theme is comprising the main results in terms of my scientific contributions to three subsequent research topics concerning the use of a special class of smart materials in heat transfer related problems, which were studied in a multidisciplinary team, at the Research Center for Complex Fluid Systems Engineering, Politehnica University Timisoara, in framework of several national and international projects. The first topic envisaged the possibilities of using magnetic nanofluids as cooling agents in microgravity thermal management systems. A fundamental study was carried out with respect to the dependence of characteristic parameters of nucleate boiling with the applied magnetic field and the magnetic nanofluid magnetic properties. The second topic envisaged also fundamental aspects regarding the natural convection in water based magnetic nanofluids, in view of their use in cooling applications for automotive engineering. The third topic had both fundamental aspects as well as application-oriented, the targets being related to the use of transformer oil based magnetic nanofluids in electric transformers,



either as cooling and insulating medium in power transformers or as magnetic liquid core in high frequency planar transformers. The results of the research reported in this thesis were disseminated in 9 ISI articles and 7 ISI proceedings papers. Also, part of the scientific contributions to the second theme are included into two national patents awarded by OSIM.

The full abstract at:

http://www.upt.ro/img/files/2016-2017/abilitare/stoian/Rezumat_habilitation_thesis_en_Stoian.pdf

Habilitation Commission

Professor Alexandru MOREGA
Corresponding member of the Romanian Academy,
University Politehnica Bucharest;
Professor Ion BOLDEA
Member of the Romanian Academy,
Politehnica University Timișoara;
Professor Viorel BĂDESCU
Member of the Romanian Academy,
University Politehnica Bucharest.