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FORCED INTRUSION OF A NONWETTING FLUID INTO A (MESO, NANO) LYOPHOBIC POROUS MATERIAL FOR (THERMAL, MECHANICAL, ELECTRIC) ENERGY STORAGE

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In the active search for a new source of energy which includes its rational utilization and storage, surface energy (a 2D energy) appears now as a challenging option thanks to new available porous materials of all sorts. In particular, large surface energy can be developed using highly porous Heterogeneous Lyophobic Systems (HLSs) which comprise a highly porous solid and a non-wetting liquid to make working bodies. Such systems exhibit high energy capacity, capability to simultaneously store (and restore) both thermal and mechanical energy, and even electric energy, during intrusion /extrusion of the liquid during compression/decompression operations. Usually an HLS is in the form of a suspension of a porous powder in the liquid. Scanning transitiometry, e.*i. P,V,T*– calorimetry, can judicially be used to submit such suspension to compression/decompression in a perfectly controlled thermodynamic way over extended *T*- and *P*-ranges. Depending on the nature of the porous solid and of the non-wetting liquid it is always possible to find a high enough pressure to force the intrusion by compression of the liquid into the pores of the solid. The compression energy being stored in the system can be further restored. Thermal and mechanical energies generated during repeated compression/decompression cycles are recorded simultaneously with the associated *P,V*-diagrams. Recent experimental measurements demonstrate that original devices making use of selected HLSs can serve as working bodies to store/restore energy, with systems behaving like molecular springs or showing negative thermal expansion

Biography

Jean-Pierre E Grolier, is emeritus professor of physical chemistry at Institute of Chemistry of Clermont-Ferrand (ICCF), France; specialist in chemical thermodynamics, calorimetry and thermal methods. Interests: experimental/theoretical studies of solutions, thermophysics of polymers under extreme conditions of temperature and pressure, thermodynamics in confined media, at the interface of heterogeneous lyophobic systems (HLSs). Member of Board of Directors of American Calorimetry Conference. First President (2002-2010) of IUPAC International Association of Chemical Thermodynamics (IACT), received (2004) the Rossini Award for excellence in Thermodynamics from International Union of Pure and Applied Chemistry (IUPAC). Dr. Yaroslaw Grosu, from National Technical University, Kiev Polytechnic Institute, is associated researcher at CIC Energigune, Minano, Basque Country, Spain. He is specialist in (meso, nano) porous materials used to store/restore energy; PhD Thesis, on Thermodynamics and Operational Properties of Nanoporous HLSs for Mechanical and Thermal Energy Storage/Dissipation, defended in 2015 at University Blaise Pascal, Clermont-Ferrand, France.

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