Investigation of Nanofluids Thermal Conductivity Modeling

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Abstract:

The pronounced heat transfer enhancement revealed experimentally in nanofluids suspensions is being investigated theoretically at the macro-scale level aiming at explaining the possible mechanisms that lead to such impressive experimental results.

Recent measurements on nanofluids have demonstrated that the thermal conductivity increases with grain size. However, such increase can not be explained by existing theories. Four possible explanations have been suggested for this anomalous increase: Brownian motion of the particles, molecular-level layering of the liquid at the liquid-particle interface, the nature of heat transport in the nanoparticle, and the effects of nanoparticle clustering. These are shown to be the key factors in understanding thermal properties of nanofluids. These models show that the effective thermal conductivity is not only a function of the thermal conductivity of solid and liquid and their relative volume fraction, but also depends on the particle size and interfacial properties. Also the relative effects of nanoparticle motion mechanisms of dilute suspension, i.e., Brownian motion, thermo-phoresis and osmo-phoresis, including size dependence, on the thermal conductivity have been theoretically investigated and reported.

Keywords: Nanofluids, Nanoparticles, Effective Thermal Conductivity.

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Analysis of Different Proposed Models for Solubility Modeling in Supercritical Fluid

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Abstract

The design and development of supercritical extraction processes depend on the ability to model and predict the solubilities of solutes in supercritical solvents. A good solubility speeds up to initial stages of extraction and reduces the time of the process to some extent. Therefore, Solubility is an important parameter for obtaining the appropriate extraction in the optimized operational condition. As a result of limitation in conducting experiments of solubility in supercritical fluid, solubility modeling and improving the existing models to obtain more appropriate models has been considered. Generally, there are three approaches of solubility modeling: i) A density-based approach, ii) A solubility parameter approach where the SCF is treated as a liquid, iii) An equation of state (EOS) approach where the SCF is treated as a high-pressure gas. In this paper we investigated these approaches.

Key word: solubility, supercritical fluid, semi-empirical model, equation of state, regular solution theory model

Water Expandable Polystyrene (WEPS) Foams

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Abstract

Water expandable polystyrene (WEPS) is polystyrene containing water cells as blowing agent. Because of environmental problems of volatile hydrocarbons blowing agents, attempts have been made to replace water as blowing agent. Because of different physical properties of water and volatile hydrocarbons, production condition, physical property and the process of EPS and WEPS will be different. In this paper, the methods of synthesis of WEPS and the recent used methods to improve the final properties of the obtained foam including the synthesis of WEPS in the presence of nanoclay and starch are studied.

Keywords: expandable polystyrene, water expandable polystyrene, foam, reverse emulsion polymerization

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Study on the Effect of Alternative Blowing Agents on Microstructure and Heat Transfer Coefficient of Rigid Polyurethane Foam

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Abstract

Rigid polyurethane (RPU) foam is widely used as insulating materials in refrigerator industries. Using of alternative blowing agent makes rigid polyurethane foam with different properties. Usually chlorofluorocarbons (CFCs), for example CFC-11, are used as blowing agent in rigid polyurethane foam in Iran. CFC-11 is an ozone depletion substance, and hence many researches have been done to replace it with alternative blowing agents. One of these alternatives is HCFC-141b with lower ozone depletion potential (ODP) respect to CFC-11, but with higher thermal conductivity than CFC-11. Thermal conductivity of alternative blowing agent is an important parameter and it could be decreased with controlling of some important parameters in RPU foam. Thermal conductivity coefficient of rigid polyurethane foam depends on some parameters such as cell structure, type and quantity of blowing agent, time, and temperature. This coefficient decreases with cell size decrement. Cell structures of rigid polyurethane foam are different in rise and transverse directions; so the thermal properties of RPU foam will strongly depend on the tests directions. Furthermore, the thermal conductivity coefficient of foam has a direct relationship with thermal conductivity coefficient of blowing agent, time and temperature. It increases monotonically with time and reaches to a constant value at a time scale.

Keywords: Rigid polyurethane Foam, Blowing agent, Heat Transfer Coefficient, Microstructure

Storage of Natural Gas in Depleted Underground Oil and Gas Reservoirs

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Abstract
Underground gas storage has become a strategic reserve for many countries and plays important role in balancing between supply and demand in different seasons. It also provides the countries with a tool to play their role in the world of energy and supports their commitment to export gas. This paper discusses different technical aspects of the underground gas storage in depleted oil and gas reservoirs. Technical and operational challenges of converting these reservoirs to gas storage is presented and discussed. Finally, underground gas storage projects in Iran are presented.

Keywords: Gas Storage, Natural Gas, Depleted Reservoirs, Permeability, Aquifer

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Thermal Machine and Refrigeration Cycle Performances on Base of Finite Time Concept

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Abstract
In this paper, the concept of finite time was applied in thermal machine and refrigeration cycle and irreversibility effects in consideration of transport phenomena were shown. The influence of time in these thermodynamic process leads to maximum coefficient of performance presented by Cruzon and Ahlborn instead of COP of a Carnot cycle for thermal machine. Calculation data shows that predicted thermal machine coefficient of performance by finite time concept is two times closer to real performance in comparison with Carnot cycle estimation. For refrigeration cycles, finite time analysis was applied and the suitable equations for prediction of COP irreversible processes by use of cycle temperatures were investigated and results were compared to real Stirling and Ericsson cycles. The calculation results show that at high temperature of heat sink, real coefficient of performance decreases and consequently, estimated coefficient of performance by finite time differ significantly with real coefficient of performance.

Keyword: Coefficient of performance, irreversibility, finite time, refrigeration cycle, thermal machine

چکیده مقالات

Effect of Impeller Types on Mixing Time in Stirred Tanks

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Abstract

Mixing time, flow pattern, and power number of a vessel depend on design and type of its impeller. That is, impeller effectiveness has often been evaluated via mixing time. In order to investigate the effect of impeller type on the mixing time, some experiments have been done for different types of impellers in a stirred vessel with a diameter of 175 mm. The mixing time measurements are carried out by means of electrical conductivity variations technique in five different rotational speeds (in the range of 4002000- rpm) for the following agitators: a two-bladed propeller, a three-bladed propeller, a four-bladed turbine, and a six-bladed turbine. Water is used as the main fluid; besides, 7cc NaCl solution with 200000 ppm concentration is injected as the tracer in a specific position. The mixing time is defined as the period between release of tracer and the time when the concentration of the tracer reaches 95% of the final concentration in the tank. By changing the type of impellers, the mixing time of different impellers have been evaluated. Indeed, the impeller giving the shortest mixing time is introduced as the best mixing impeller for the governed experimental conditions. It has been shown that increasing the rotational speed leads to a considerable decrease in mixing time and an increase in turbulency. Finally, by installing some baffles in the tank diminishing of vortexes is observed; consequently, mixing time decreases.

Keywords: Stirred tank, Mixing time, Impeller types, Baffle, Rotational speed.