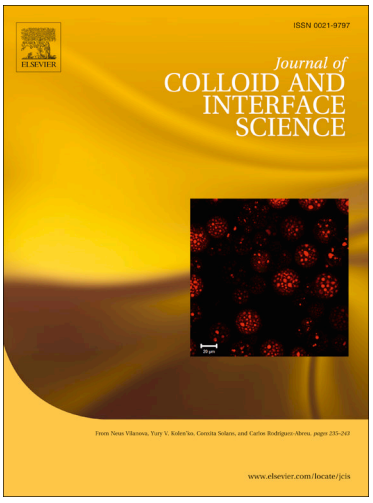

Acid-functionalized carbon nanofibers for high stability, thermoelectrical and electrochemical properties of nanofluids

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Acid-functionalized carbon nanofibers for high stability, thermoelectrical and electrochemical properties of nanofluids

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Abstract

Carbon-based nanofluids are viewed as promising thermal fluids for heat transfer applications. However, other properties, such as electrical conductivity and electrochemical behavior, are usually overlooked and rarely investigated despite their importance for the overall performance characterization of a given application. In this study, we synthesized PAN-based carbon nanofibers (CNF) by electrospinning, and characterized them using electron microscopy, X-ray diffraction, X-ray photoelectron spectroscopy, Raman spectroscopy, and thermogravimetric analysis. Thermoelectrical and electrochemical measurements were carried out on nanofluids. We found that, although CNF nanofluids exhibit good thermal and electrical properties with a negligible corrosive effect, the suspensions tend to sediment within a few days. However, acid treatment of CNF (F-CNF), which resulted in the shortening of the fibers and the appearance of surface-oxygenated species, made F-CNF-based nanofluids exhibit superior stability in water that extended for more than 90 days, with consistent and superior thermal and electrical properties.

Keywords: Carbon nanofiber, Nanofluid, Thermal conductivity, Stability, Corrosion,

1. Introduction

Heating or cooling fluids are involved in many industrial applications, such as energy production and supply, solar thermal collectors, chemical engineering, electronics, and so forth[1]. Nanofluids, which are liquid suspensions of nanometer-sized solid particles, such as metals, metal oxides, carbon-related materials, and so on, have been the focus of intensive research because of their potential use as heat transfer fluids [2]. Nanofluids have higher heat conductivity and better convective heat transfer capability than conventional fluids (e.g., water, ethylene glycol, etc.) while mitigating

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