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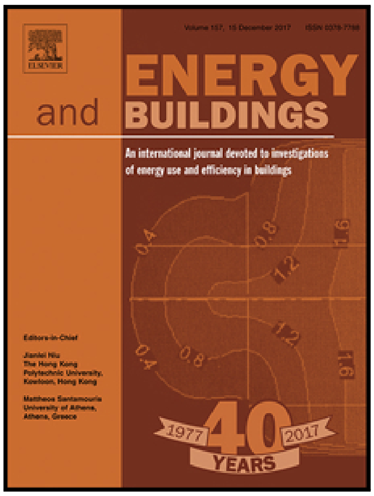

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Carbon Nanotube Heat Transfer Fluids for Solar Radiant Heating of Buildings

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Abstract

Solar-based radiant heating systems represent a sustainable, and relatively low-cost, technology to raise the temperature of the interior thermal mass of our buildings. Through the use of direct absorption solar thermal collectors, the same working fluid which absorbs the solar energy can be used to transfer the energy for storage in the thermal mass of the structure using a network of pipes embedded in concrete floors. This study investigates a promising working fluid which can be used in such systems – one which is based on multi-walled carbon-nanotubes suspended in normal base fluids. A major stumbling block affecting the wide spread use of carbon-nanotube nanofluids is their low dispersion stability at elevated temperatures, which significantly reduces the absorption capabilities of the nanofluids and could lead to clogging of the pumps used to circulate the fluids. In this paper, we report on a scalable UV-ozone (UVO) treatment technique to produce highly stable dispersions for the elevated temperatures experienced by working fluids in radiant heating systems. To probe suitability of UVO treated multi-walled carbon-nanotube (MWCNTs) for solar-assisted radiant heating systems, this paper investigates the effects of exposure time and temperature on stability, optical absorbance properties, the extent of functionalisation, and the photothermal conversion performance of UVO-treated MWCNT nanofluids. No agglomeration or degradation of the MWCNTs was observed at elevated temperatures (up to 150^{o}C), highlighting the stability of proposed nanofluids.

Keywords: Thermal Stability, Carbon Nanotubes, Radiant Heating Systems

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