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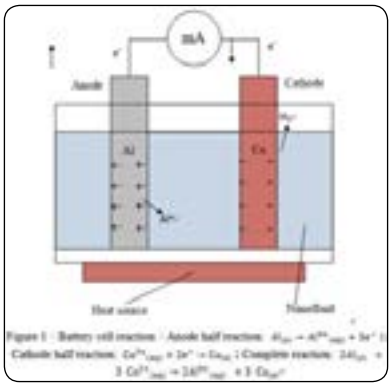
Jung Chang Wang

National Taiwan Ocean University, Taiwan

Thermal energy storage of alumina nanofluids using innovation dimensional analysis

A two-step synthesis preparing the thermoelectric nanofluids through an ultrasound technique was studied in the present article. The best mixing method was determined by a sedimentation experiment of suspendibility, stability, and thermal conductivity. 0.5-2.5 weight-percent concentration (wt.%) thermoelectric nanofluids were added into a battery cell with copper and aluminum electrodes for an oxidation reduction reaction to test the generating capacity between 20 and 40°C. Two empirical formulas of thermal conductivity and generating capacity for thermoelectric nanofluids were derived by the innovation dimensional analysis. The results of the property verification and experimentation indicated that thermoelectric nanofluid and emulsifying agent mixture at a concentration of 1 wt.% had the best thermal conductivity, and that this decreases as the concentration increases. At 40°C, 2.5 wt.% thermoelectric nanofluid also had the highest electric charge density; however, the rate of increase was less than 7% higher than that for 2 wt.% thermoelectric nanofluid. The results also indicated that for 0.5-2.5 wt.% thermoelectric nanofluid between 20-40°C, inserting the temperature and concentration parameters can estimate the thermal conductivity and the electric charge density using the empirical formulas in the present study.



Recent Publications

1. R T Wang and J C Wang (2017) Analysis of thermal conductivity in HI-LEDs lighting materials. Journal of Mechanical Science and Technology. 31(6):2911-2921.
2. R T Wang and J C Wang (2017) Intelligent dimensional and thermal performance analysis of Al2O3 nanofluid. Energy Conversion and Management. 138:686-697.
3. R T Wang and J C Wang (2016) Analyzing the structural designs and thermal performance of nonmetal LED lighting devices of LED bulbs. International Journal of Heat and Mass Transfer. 99:750-761.
4. R T Wang and J C Wang (2016) Alumina nanofluids as electrolytes comparisons to various neutral aqueous solutions inside battery. Journal of Mechanics. 32(3):369-379.
5. R T Wang and J C Wang (2015) Optimization of heat flow analysis for exceeding hundred watts in HI-LEDS projectors. International Communications in Heat and Mass Transfer. 67:153-162.

Biography

Jung Chang Wang is a Full Professor in the School of Marine Engineering, National Taiwan Ocean University, Keelung, Taiwan, and is also the Director of the Thermal-Fluid Illumination Laboratory. He received his Bachelor and Master Degrees from National Cheng Kung University and PhD (Mechanical) from National Taiwan University in Taiwan in 2007. He has been teaching and researching on electronic heat transfer and renewable energy for more than ten years. He has published more than 100 research papers in international journals, conferences and patents, and edited five book chapters. His main research interest includes applied and software engineering in thermal-fluid science.

jcwang@mail.ntou.edu.tw

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