Abstract

In this work, there is an investigation of the thermal transport behavior of nanoparticle colloids or nanofluids. The major efforts are: to determine methods to characterize a nanoparticle colloid's mass loading, chemical constituents, particle size, and pH; to determine temperature and loading dependent viscosity and thermal conductivity; to determine convective heat transfer coefficient and viscous pressure losses in a heated horizontal tube; and finally to determine the feasibility for potential use as enhanced coolants in energy transport systems, with focus on nuclear application.

The efforts have resulted in proving that the two selected nanofluids, alumina in water and zirconia in water, have behavior that can be predicted by existing single phase convective heat transfer coefficient and viscous pressure loss correlations from the literature. The main consideration is that these models must use the measured mixture transport properties. With the acquired knowledge of the experiments, investigation into the potential use or optimization of a nanofluid as an enhanced coolant is further explored. The ultimate goal of contributing to the understanding of the mechanisms of nanoparticle colloid behavior, as well as, to broaden the experimental database of these new heat transfer media is fulfilled.

Bio

Wesley Williams is a very recent Ph.D graduate from the MIT Nuclear Science and Engineering Department. He has spent the past four years working on advanced nuclear reactor cooling concepts both experimentally and theoretically. His efforts at MIT helped to create four currently functioning experimental facilities in the newly revitalized Thermal-Hydraulics Laboratory.

Prior to his work at MIT, he received a M.S. and B.S. from the University of Tennessee in Nuclear Engineering and Mechanical Engineering respectively. He also had a summer internship during 2002 at ORNL under the NESLS program.