ABSTRACT

Passive cooling system technology in modern nuclear reactors has undergone rapid development and is planned to be applied to Generation IV nuclear reactors to improve safety systems. Natural circulation-based passive cooling systems have a significant impact. These systems utilize the movement of cooling fluids to transfer heat. The innovative use of nanofluids as cooling fluids has the potential to improve cooling capabilities due to increased thermal conductivity. However, the database of thermal properties of nanofluids is still limited due to many influencing factors. This study focuses on the design of a thermal conductivity measuring device for liquids, specifically nanofluids, using the transient hot-wire (THW) method. The THW method was chosen because of its fast testing and high accuracy for liquid samples. The main components in the device design use nichrome wire as a heat source and a type-K thermocouple to measure the temperature increase. The test results on deionized water showed a small relative error of 0.581% against the reference value obtained from testing using commercial equipment. Al_2O_3 0.1% nanofluid had a relative error of 2.525%. Meanwhile, ZnO 0.1% and TiO_2 0.1% had errors of 14.596% and 10.401%, respectively. The high error in these nanofluids was due to differences in sample conditions during testing between the two instruments. In tests using the designed instrument, the nanofluids were tested immediately after the manufacturing process. Meanwhile, in tests using commercial instruments, there was a delay between the time the samples were made and the time they were tested. This may have caused the nanofluids to settle, resulting in a decrease in thermal conductivity. Although the absolute accuracy of the designed instrument compared to commercial instruments cannot yet be confirmed, this study successfully proves that the sample settling time interval causes a decrease in thermal conductivity in nanofluids.

***Keywords** : transient hot-wire, thermal conductivity, passive cooling system, heat transfer, nanofluids*