

ABSTRACT

FORCED CONVECTION HEAT TRANSFER ANALYSIS OF WATER- Al_2O_3 NANOFLUIDS IN VERTICAL HEXAGONAL SUB-CHANNEL

Cooling system is a very important aspect in safety during the operation of nuclear reactor. So far a cooling system in nuclear reactors only use fluid water as a coolant. Recently nanofluids become popular among researchers because nanofluids has better heat transfer ability than water. Before nanofluids is applied as a coolant in reactor, many things that have to be reckoned such as the dimension, size, types of fluid flow, types of nanofluids and concentration of nanoparticles in base fluid would affect the value of heat transfer coefficient. This research used water- Al_2O_3 nanofluids as a cooling fluid that was applied in a vertical hexagonal sub-channel and using forced convection flow. The research equipment and the arrangement of heating pipes have been designed to resemble the structure of nuclear reactor core and terrace of reactor TRIGA BATAN Bandung.

This research attempts to get heat transfer empirical correlation of water- Al_2O_3 and to determine the comparison of heat transfer coefficient when using pure water and water- Al_2O_3 nanofluids as reactor coolant.

The heat transfer empirical correlation in forced convection flow using water- Al_2O_3 nanofluids as a cooling fluids from this research could be written in equations below.

Flow rate of 6 liter/minute : $Nu = 6,321 Gz^{0,446}$; $159,012 \leq Gz \leq 556,542$

Flow rate of 10 liter/minute : $Nu = 0,864 Gz^{0,761}$; $265,020 \leq Gz \leq 927,570$

Flow rate of 12 liter/minute : $Nu = 1,727 Gz^{0,707}$; $318,024 \leq Gz \leq 1113,084$

The result showed that heat transfer coefficient of water- Al_2O_3 nanofluids is higher about 90%-100% than heat transfer coefficient of water. It has been proven by both of empirical correlation and experimental data.

Keywords: nanofluids, sub-channel, hexagon, Al_2O_3 , heat transfer coefficient, forced convection.