Abstract

In the present work, experimental and numerical investigations had been carried out to investigate the effect of sub-millimeter bubbles injection on heat transfer coefficient of upward flowing water in vertical mounted tube subjected to uniform heat flux. The experimental apparatus consists of a test rig designed and built to conduct the experiments. A circular tube, test section was designed and constructed from the copper and heated by an electrical heater on its outer surface. The dimensions of copper pipe was (length= 0.7m, diameter= 0.05 m, thickness= 1.5 mm). Water temperature at inlet was kept constant at (32°C). Thermocouples distributed longitudinally at different radial distances between cylinder surface and its center at seven sections, in addition to the fluid inlet and outlet were used to measure temperatures. Bubbles generation was performed in test section by using a proper ionization current that will be passed across the anode and cathode electrodes to produce hydrogen bubbles and oxygen bubbles at different intensities. The experiments were conducted using heat fluxes (13641 and 22736) W/m2, water mass flow of (2, 3 and 4) lit/min, mass flow rate of hydrogen and oxygen
bubbles were (0.02, 0.025) lit/min respectively and Reynolds number (1214, 1783 and 2300) for water. The results showed that an enhancement of 25.5% was obtained in the averaged Nusselt number with using ionization bubbles compared with the case without bubbles.

References


Index Terms

Computer Science
Power Electronics

Keywords

Hydrogen and oxygen bubbles, Bubble injection, Two-phase flow, Water electrolysis