Proceedings of the 7th International Conference on Fluid Flow, Heat and Mass Transfer (FFHMT'20)
~~Niagara Falls, Canada~~ Virtual Conference – November, 2020
Paper No. 171
DOI: 10.11159/ffhmt20.171

Effect of Multiple Water Impinging Jet Array on Quenching Hot Rotary Hollow Cylinders

Mohammad Jahedi[1], Bahram Moshfegh[1,2]
[1]Department of Building Engineering, Energy Systems and Sustainability Science, University of Gävle
801 76, Gävle, Sweden
Mohammad.jahedi@hig.se; bahram.moshfegh@hig.se
[2]Department of Management and Engineering, Linköping University
583 30, Linköping, Sweden

Abstract **-** Experimental study has been carried out to investigate transient quenching of a rotary hollow cylinder by water impinging jets in multiple jet arrays. Subcooled water jets (ΔT_{sub} = 55-85K) were placed into two types of nozzle arrays: 1-row and 2-row in-line array. The flow rate of water jets varied from 2.7 to 10.9 L/min, impinging on hot rotary cylinder (T_i =600°C) with rotation speed 10-50 rpm and different curvature ratio (D_o/d = 12, 19 and 24). The local average and maximum boiling heat transfer at water jet's stagnation point revealed effect of studied quenching parameters and multiple jet arrays in the boiling heat transfer. The result showed among the studied parameters, jet's flow rate and curvature ratio influenced heat transfer in all the boiling regimes. Rotation speed was effective in film and transition boiling regime and strong effect of subcooling was captured in the transition boiling regime. The characteristics of maximum heat flux point in the boiling curve were found to be dependent on the studied quenching parameters as well as array of nozzles. Multiple jet arrays had effect on the spatial variation and rate of boiling heat transfer on quenching surface. Higher area-averaged and maximum surface heat flux was obtained by 2-row array while array's total flow rate was kept constant. It was found that by impinging constant water flow rate into the jets, 2-row array with twice the number of impinging jets enhanced heat transfer significantly in film and transition boiling regime in combination with other quenching parameters.

Keywords**:** Multiple jet arrays, Transient boiling, Rotating surface, Inverse heat conduction problem, Quenching, Water impinging jet