

Saturated Nucleate Boiling with HFE-7100 on a Plain Smooth Copper Surface

Xiaoguang Fan^{1, 2}, Mohamed M. Mahmoud^{2,3}, Atanas Ivanov², Tassos G. Karayiannis²

¹Shenyang Agriculture University
120 Dongling Rd. Shenhe District, Shenyang, China
xiaoguangfan1982@syau.edu.cn

²Brunel University London
UB8 3PH, London, UK

mohamed.mahmoud@brunel.ac.uk; atanas.ivanov@brunel.ac.uk; tassos.karayiannis@brunel.ac.uk

³Faculty of Engineering, Zagazig University, Zagazig, Egypt, 44519
mbasuny@zu.edu.eg

Abstract - Pool boiling is one of the main modes of heat transfer in many industrial applications. Therefore, the pool boiling heat transfer performance of various surfaces/geometries and the establishment of reliable predictive correlations has received a lot of attention from laboratories across the world. Visualization and heat transfer measurements of pool boiling using hydrofluoroether HFE-7100 as the working fluid on a plain smooth copper surface are described in this paper. The polished boiling surface had an average surface roughness of 0.019 μm . The saturated pressure ranged from 0.7 to 2 bar. The saturation pressure was found to affect the number of active bubble nucleation sites at a given temperature difference between the wall and the saturation temperature, delayed the formation of bigger bubbles and affected the pool boiling heat transfer. Starting with the lower pressure of 0.7 bar, the heat transfer coefficient increased by an average of 24%, 49% and 60% for saturated pressure of 1.0, 1.5 and 2 bar respectively. The corresponding increase in the critical heat flux (CHF) was 27%, 48%, and 64%. The obtained experimental nucleate boiling heat transfer data as well as the CHF were compared with well-known correlations reported in the literature.

Keywords: Pool boiling, heat transfer coefficient, critical heat flux, saturated pressure, correlations.