Thesis Title	Internal Corrosion of Thermosyphon Heat Exchanger	
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Abstract

The purpose of this study was to study an internal corrosion of a thermosyphon heat exchanger which used for waste heat recovery. The thermosyphon tubes were made of aluminium, copper and iron with plain internal surface, and copper and stainless with spiral grooved internal surface. The corrosion protection methods were varied by burning tubes with temperature of 550°C at specified times or adding an inhibitor (Na_2HPO_4) to working fluid at several concentrations, or the combination of these two methods. The results were then compared with those from the normal tubes. The test was continuoued for 4000 hours at temperature about 150°C, 250°C and 350°C respectively. The aimed results were the average corrosion rate which defined from lost weight of tube after testing, the maximum corrosion rate which obtained from maximum pit depth in the cross section of tube, the coated substances on internal surface of tube which could be analysed by X-ray diffractometer and Infra-red spectroscopy, the amount of hydrogen in tube which obtained from Gas chromatography and the total heat transfer resistance of thermosyphon which calculated from surface temperature recorded every 240 hours at any sections of thermosyphons. Arrhenius model and

Fouling model of Kern and Seaton were employed to analyse these data. It was found from experiments that, the average corrosion rate is an inversed proportion to time and depends on temperature with the correlations : $Cr = At^{(B)}$ and $Cr = Ce^{(D/T)}$ respectively, where t is time, T is temperature and A, B, C and D are constants depend on tube material and corrosion protection. The maximum corrosion rate is an inversed proportion to time and depends on temperature with the correlations : $Cr_{max} = At^{(B)}$ and $Cr_{max} = Ce^{(D/T)}$ respectively. The amount of hydrogen in the tube is proportional to time and temperature with the correlations : $V = ALn(t) + B$ and $V = C/T + D$ respectively, where A, B, C and D are constants depend on tube material and corrosion protection. For aluminium tubes, the coated substances on internal surface are bonds of O-H, SiO and OSiO. For copper tubes, iron tubes, copper tubes with internal grooved and stainless tubes with internal grooved, the coated substances are found to be bonds SO and OSO. It was seen that, the appropriate material for thermosyphon in waste heat recovery system is copper tube with grooved internal surface. The appropriate corrosion protection for this material is by adding 20 ppm of inhibitor Na_2HPO_4 in working fluid. It can be concluded that, the fouling thermal resistance is proportional to time and can be obtained from the following correlation;

$$Z_{fouling} = 177.78(1-e^{-0.0001t})$$

Where $Z_{fouling}$ is fouling thermal resistance

t is time