Laboratory 4

Fluidised Bed Heat Transfer
Supervisor: Dr J. Zhang

Aims:

To understand fluidisation process and heat transfer characteristics in a fluidised bed.

Experimental system:

Hilton Fluid Bed Heat Transfer Unit

Objectives:

(1). To observe fluidisation process.
(2). To determine the heat transfer coefficient in a fluidised bed.
(3). To observe the effect of operational temperature on the heat transfer coefficient.

Experimental procedures:

After familiar with the experimental system, the following procedures are suggested.

(1). Observation of fluidisation process

With the air valve set to discharge fully to atmosphere, switch on the fan.

The air valve is now to be turned steadily and progressively to divert air through the bed, whilst noting flow rates on the Rotameters, bed pressure drop on the previously zeroed manometer, and bed phenomena.

Plot the pressure drop ΔP (cm H_2O) against air flow (l/min), using log transformation of both variables.

(2). Heat transfer in a fluidised bed

Set the air flow at 1.4 l/s to give fully fluidised condition.

Set the temperature indicator to the heating element thermocouple.

The variac is now adjusted to maintain the heating element at a predetermined temperature, e.g. 50^{o}C.

Calculate the heat transfer coefficient from the following equations.

$$q = h * A * \Delta T$$
$$q = I * U$$

where A=0.002m^2, heating element surface area

I: current (Amps)

U: voltage (Volts)

ΔT : temperature difference between the heating element and the surroundings (K)

h: heat transfer coefficient (W/m^{2}K)

q: energy (W)

Set the air flow at 0.9 l/s and 1.1 l/s, repeat the above procedure.

Repeat the above for several different operational temperatures, e.g. 100^{o}C, 150^{o}C.