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Supplementary Information

Chemical synthesis of Silver/graphene and the nanofluid using it for coolant applications

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1. Validity of the experimental setup with DI water

Figure 1 shows the photograph of the experimental setup used for heat transfer study. To check the reliability and accuracy of fabricated experimental setup, systematic measurements were carried out using distilled water alone as the working fluid both for laminar flow and turbulent flow. The experimental results obtained by different flow rates were correlated with well known Shah correlation [1] and Dittus-Boelter [2] equation respectively under the constant heat flux boundary condition. The famous Shah correlation is

$$Nu = \begin{cases} 1.953\,(RePr\frac{D}{x})^{1/3} & (RePr\frac{D}{x}) \geq 33.3 \\ 4.364 + 0.0722\,RePr\frac{D}{x} & (RePr\frac{D}{x}) < 33.3 \end{cases} \quad \text{--------} (')$$

where Nu is the Nusselts number. The experimental values were reasonably in good agreement with the Shah equation as shown in figure 2a. The same was observed for other laminar flow rates also. Similarly for Reynolds number greater than 10000, the Dittus-Boelter correlation equation is as follows,

$Nu=0.023\ Re^{0.8}Pr^{0.4}$ ---------- (2)

As shown in figure 2b, the good coincidence between the experimental results and the calculated values for water reveals that the precision of the experimental system is considerably good. The uncertainty of the experimental system is less than 8 percent.

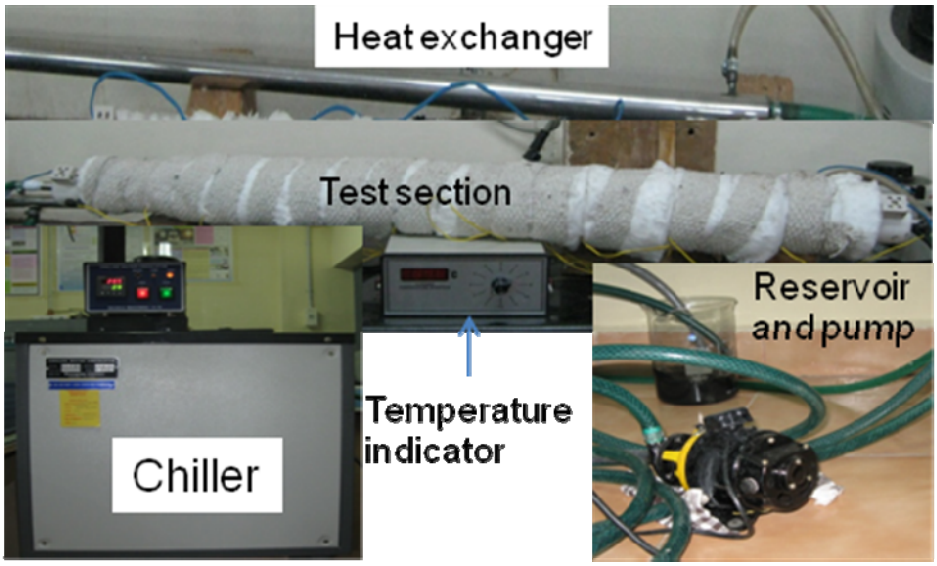

Fig. 1 Photograph of the heat transfer setup.

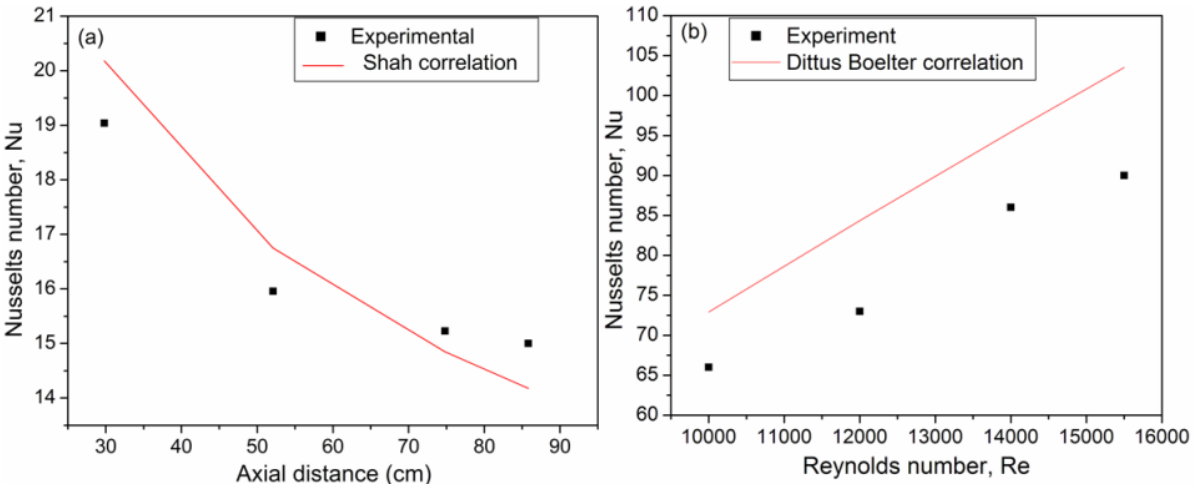

Fig. 2 Validity of the experimental heat transfer setup for (a) low flow rate and (b) high flow rate using water.

References

1. R.K. Shah, Thermal entry length solutions for the circular tube and parallel plates, in: Proc. 3rd National Heat Mass Transfer Conference. Indian Institute of Technology, Bombay, 1975, 1, Paper no. HMT-11-75,

2. F.W. Dittus and L.M.K. Boelter, Heat Transfer in Automobile Radiators of the Tubular Type, *Uni. of California Pub.in Eng.* 1930, 2, 443-461.