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Experimental measurement of CO₂ diffusion coefficient in water based nanofluids

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The objective of this paper is experimental measurement of CO₂ diffusion coefficient in different nanofluids including (SiO₂), aluminum oxide (Al₂O₃) and titanium oxide (TiO₂) nanofluids. Nanofluids in concentrations of 0.05, 0.1 and 0.2 wt% were used in experiments. Different factors such as temperature, weight percentage of nanoparticles, as well as the effect of particle size were investigated on CO₂ diffusivity. The results clearly show that at 25°C, the highest CO₂ diffusivity occurred for 0.2% concentration of TiO₂ nanofluid which is 6.5×10^{-9} m²/s. Also, at 30°C, the highest CO₂ diffusivity was obtained for 0.05% concentration of SiO₂ nanofluid which is 7.8×10^{-9} m²/s. In addition, the highest CO₂ diffusivity for 0.1% concentration of TiO₂ nanofluid at 35°C was 14.7×10^{-9} m²/s. Finally, a new correlation was developed for the effective diffusion coefficient of CO₂ in nanofluid based on the nanofluids Reynolds (Re) number, nanoparticles Reynolds (Renp) number, Schmidt (Sc) number and nanoparticles volume fraction with an average relative error percent (REP) of 9.58% and R² of 0.945.

References

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