Viscosity Measurements of Binary Mixtures of Difluoromethane (R-32) and 2,3,3,3-Tetrafluoropropene (R-12324yf) Refrigerants and Their Empirical Models

Monjur Morshed[1, S, C], Atiqur R. Tuhin[1] and Akio Miyara[1]

[1]*Department of Mechanical Engineering, Saga University, Saga, Saga-ken, Japan*
mmon.research@gmail.com

In response to global initiatives to combat ozone depletion and climate change, there has been a marked increase in the adoption of hydrofluoroolefins (HFOs) and their blends. Notably, the R454 series, which includes mixtures of difluoromethane (R-32) and 2,3,3,3-tetrafluoropropene (R-12324yf), is gaining prominence for industrial applications. This study focuses on the viscosity measurements of R454B and R454C using the Tandem Capillary Tube method, a technique superior to single-tube viscometers. This method effectively negates pressure fluctuations at the ends of the tubes by employing a series arrangement of long and short capillary tubes and superimposing their pressure distributions, ensuring more accurate viscosity readings. The research involved collecting data under varied conditions: in both compressed liquid and vapor phases, within a temperature range of 312 K to 393 K, and at pressures from 2 MPa to 4 MPa. The experiments were carefully conducted with mole fractions set around 0.83/0.17 for R454B and 0.37/0.63 for R454C. This study not only provides novel experimental data but also engages in a comparative analysis with existing literature. The assimilation and comparison of this new data with previously published measurements available in the literature, coupled with the development of empirical models, greatly advance the potential industrial use of these eco-friendly refrigerants. The findings from this study are instrumental in paving the way for the broader application of these refrigerants, aligning with the global trend towards more sustainable and environmentally conscious industrial practices.