Measurement of Vapour Pressure of the Binary Mixture R 22/ R 152a

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Global concerns to save the environment by avoiding the depletion of ozone layer, have resulted in restrictions in production and phase out of chlorofluorocarbons (CFCs) and hydroflourocarbons (HCFCs). Hence the search for alternatives to CFCs and HCFCs has attracted the attention of the scientists from many disciplines. Information about vapor pressures is important initially to qualify potential candidates as working fluids in refrigeration machinery. Later, it is also very useful in calculating the thermodynamic properties necessary for the cycle analysis and the design of the refrigeration equipment. These are the subjects of much current interest due to the imminent ban on the familiar CFCs and the eventual phase out of the HCFCs as working fluids. One of the basic experiments to develop thermodynamic properties is finding the vapor pressure. Therefore experiments have been conducted in the vapor pressure determination test rig in the laboratory, which uses the static method as the working principle. The vapor pressure data generated, using equipment working on a static measurement principle, posses error due to impurity present in the sample and also due to inheritance error in the equipment. Even though the vapor pressure data of R12 (Dichlorodifluoromethane) are available in the literature, experiments have been conducted to confirm the reliability of the data generated and to find correction factors if necessary.

It is necessary to find an equation to predict the vapor pressure, for interpolation between experimental data and also to generate vapor pressure values to use anywhere. Hence curve fitting with “Curve Expert” is done for the experimental data and a best curve fit has been found for each refrigerant. Also from the literature it is found that most of the authors used Wagner and Riedel equations to fit vapor pressure data for most of the fluids. Hence these equations are also fitted to the experimental data. The errors have been correlated to find the correction factor, which can be applied to vapor pressure data of new refrigerants, whose vapor pressure data is not available. The vapor pressure data generated by the equations recommended for a particular refrigerant and applying correction factor, one can get the vapor pressure data with maximum error of 9 % for pure components and 10 % for mixtures. Experiments have been conducted for the mixtures of R 22 and R 152a (1,1-difluoroethane), whose vapor pressure data are not available. Also theoretical vapor pressure data of mixtures R22/R152a have been calculated. The experimental data of the mixture R22/R152a is compared with theoretical values and a maximum deviation of –10 % was found. The RMS error of the measurement using this instrument was 5.6 %.