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Additional Gibbs Energy and Saturation Pressure of the Environmentally Friendly Refrigerant Mixture

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Abstract: *This work presents the drenching pressure of new innocuous to the biological system refrigerants 1,1-difluoroethane (R152a)and1,1,1,3,3-Penta fluor butane (R365mfc), beside their mixture. Special attention was given toenablea highly accurate predicted submersion strain and excess Gibbs energy data as capacity of design in a temperature extent of T=260K toT=380K, for the pure fluid and the mixture.The multiplication data for the inundation pressure were gotten using the modifiedUnifac technique, Lee Kesler and Hoffman Florin models and supported with the high exactness essential states of state by Outcaltand McLindenfrom National Institute of Standardand Technology (NIST). Among all the model of Lee and Keslerhave shown extraordinary results for fitting the light aspect R152a, most outrageous positive deviation under 1% was reached. Where asthe model of Hoffman Florin yielded extraordinary results for R365mfc, most outrageous positive deviation under 2.85% was reached. The excess Gibbs energy capacity for the blend was recognized in a temperature extent of T=260K to T=380K by the modified UNIFAC method.*

Keywords: *R152a, R365mfc, Excess Gibbs Energy ,Lee Kesler, HoffmanFlorin,Unifac.*

I.INTRODUCTION

Since the declaration of the Montreal show in 1987 the usage of the frightful materials of Chloro fluoro carbons (CFCs) and Hydro-chlorofluorocarbons (HCFCs) based refrigerants in the air is subsequently overseen [1]. These materials have been widely used as solvents, foam blowing trained professionals, fume sprayers and especially as refrigerants due to their predominant properties, for instance, stability, non-noxiousness, non-instability and availability. In any case, these substances horrendously influence the world's protective ozone layer. Other than the CFCs had been seen as materials adding to the idiosyncrasies of the all inclusive temperature help. The international efforts have legalized to stop the consumption of CFCs by replacing them with new HFCs [3-5].

This paper maintains most critical thermodynamics data for those materials, including the pure fluids and blends of R152a andR365mfc.The R152aisaHFCtype refrigerant. This fluid has zero ODP and a GWP value of120.The boiling point temperature at a kind of p=1.013 bar is □s=-24.0°C, the nuclear weight M=66.1 kg/kmol. R152a is a medium strain refrigerant for the medium temperature refrigeration range [2]. The physical, thermodynamic and refrigeration characteristics are similar to those of the refrigerants R12 and R134a. Although R152a is a good refrigerant substitute for R12, it is not used in its pure form because of its instability (instability limits 3.7-21.8% by volume in air). Thus, R152a is set apart as "significantly burnable". TheR365mfc is a HFC type refrigerant. This fluid has zero ODP and a GWP worth of 782. The edge of bubbling over temperature at a pressure p=1.013 bar is □s=+41.4°C, the sub-nuclear weight is at M=148.07 kg/kmol. R365mfc is another fluid which is generally used for the production of rigid polyurethane froths used in security purposes where a liquid foaming expert with a low warm conductivity and a high vapor pressure at low temperatures are needed. Regarding to thermodynamic properties and security requirements,R365 mfc is used as an essential part in twofold blends in with 7 or 13 mass% with 1,1,1,2,3,3,3-Heptafluoropropane (R227ea) in the making of liquid foaming experts [2]. Other than the way that this fluid antagonistically influences the ozone layer, further environmental benefits can be achieved using R365mfc, as in the production of polyurethane froths. To the best of our knowledge, only a very limited proportion of data for the excess Gibbs energy and splashed type of R365mfc and R152a are available in the literature.

II. PREDICTIVE MODELS

In 1975, the UNIFAC group contribution method was published by Fredenslund et al. [2]. Like the ASOG method, the UNIFAC method is based on the solution of groups concept. However in the UNIFAC method, the activity coefficients are calculated

from a combinatorial and a residual part exactly like in the UNIQUAC model. In this method the temperature independent combinatorial part takes into account the size and the form of the molecules, which considers the entropic contribution and the residual part, considers the enthalpic interactions as follows:

Table I. Properties of the fluids.

Component	M_w(kg/kmol)	T_c(K)	P_c(bar)	ρ(kg/m^3)	ω
R365mfc	148.07	460.0	3266.0	473.84	0.377
R152a	66.051	386.41	4516.8	368.0	0.27521

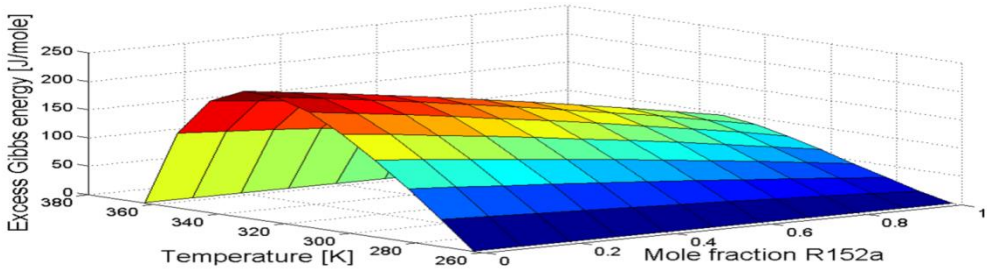

Fig.1.Excess Gibbs energy predicted for the system R152a(1) and R365mfc(2) by modified UNIFAC.

III.RESULTS AND DISCUSSION

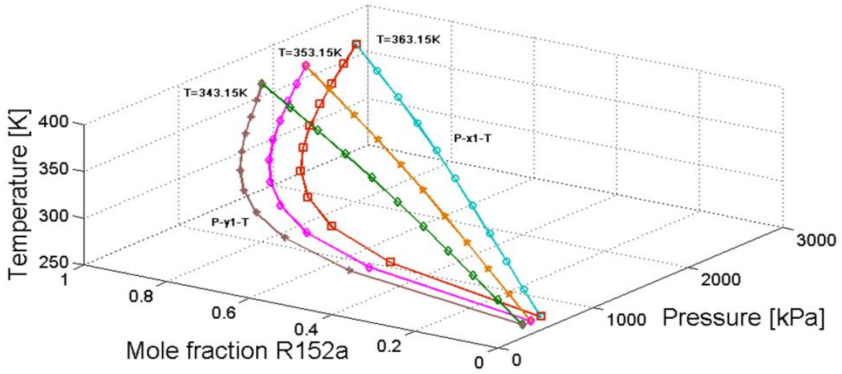

Fig.2.P-T-xy diagram from modified UNIFAC for the system R152a(1) and R365mfc(2).

As a fundamental capacity in the field of thermodynamics, Fig.1 outlined the assumption for excess Gibbs energy for the system R152 and R365mfc as a component of temperature and creation near with more shaky part R152a by changed UNIFAC method. It is to be referred to that capacity is solidly dependent upon synthesis and temperature of mix. The capacity probably increases as temperature and creation extension in a rising curve until showing up at explicit piece of 0.7, and the twist then exhibits upset character while showing up at the ideal behavior of pure part upon which its regard changes into a zero. Excess Gibbs energy capacity recommends different effects related with the mixing of various particles and gives the blazing effect to molecules due to the variation of intermolecular forces and besides the entropic influence presented by excess entropy ability. This results from a shortfall of complete hap hazard ness in movement of molecule in mix. The concordance state of the system R152a and R365mfc is presented in a three layered P-T-association chart for temperature range 263.15K-363.15K in Fig.2. This figure shows schematically the P-T-association surfaces which contain the agreement states of doused seethe and inundated liquid forthis two fold mix, where R152a is the more erratic part and R365mfc is the less unsound part. The lower surface contains the splashed smoke states which known as P-T-y surface.

IV.CONCLUSIONS

The work has passed on various thermodynamic data zeroing in on the Excess Gibbs energy ability and the drenching pressure of the innocuous to the environment course of action of R152a and R365mfc. The liquid stage lead of the mix was investigated using the group responsibility procedure for changed UNIFAC, which exhibited its stead fastness to expect the excess Gibbs free energy

model. The work has more over explored judicious models for the submersion pressure, explicitly the Lee Kesler and Hoffman-Florin, contiguous the high precision significant states of state by Outcalt and Mc Linden from Public Foundation of Standard and Advancement (NIST). The simulation results achieved good agreement with the experimental data by Outcalt and Mc Linden (NIST).

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