

## **Phase Equilibria in the Low GWP Azeotropic Refrigerant Blends**

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This paper describes the latest attempts to identify azeotropic mixtures with a normal boiling point between -40 and -80°C. The aim was to match the saturated pressure-temperature characteristics and refrigerating capacity of existing refrigerants within this range. Of a large number of potential combinations, three azeotropic mixtures, R1270/R161, R170/R717, and R600a/R161 have been identified, all formed from natural refrigerants or synthetic chemicals with a global warming potential GWP < 150. Each of these has distinct characteristics and is suited to certain types of applications. A number of P – T - x measurements were conducted for mixtures of interest over a variety of thermodynamic variables. Based on the results of the measurements, a thermodynamic model was developed using the Peng – Robinson type equation of state (EoS) to predict the phase behaviour of the full range of compositions, pressures and temperatures. These new blends offer notable advantages over existing refrigerants, in particular:

- Zero ODP and low GWP, below 150, and mainly “naturally” occurring
- Improved thermodynamic properties (such as critical temperature and minimal temperature glide) over similar existing refrigerants
- Good solubility with oils
- Low toxicity, and reduced flammability
- Known and understood chemical and material compatibility