

Properties of a CO₂-HC Mixture as a New Possible Low GWP Refrigerant

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The use of environmentally friendly refrigerants with a low GWP value is discussed more intensively than in the past. The so called climate neutral refrigerants CO₂ and hydro-carbons (HC) are already used for numerous applications like industrial cooling and heat pumps. The pure components or the mixtures of these are potentially advantageous alternatives in comparison with fluorinated refrigerants in terms of their low GWP values. The aim of the study was to develop a refrigerant that is more energy efficient than CO₂, especially in the temperature range above the supercritical temperature of pure CO₂. The addition of different HC units increases the critical temperature in comparison to pure CO₂, which is also a benefit for subcritical working process of cooling machines. The thermodynamic properties of a CO₂-HC mixture with two oils, a polyalkyl glycol (PAG) oil, and a polyol ester (POE) oil were investigated. The study includes measurement of the density by a tending vibration method, the determination of the vapour pressure with a static measuring apparatus and the investigation of dynamic viscosity with a rotation viscometer. The investigated mixtures ranged from 100 wt% to 70 wt% for the oils. The miscibility of the CO₂-HC mixture with the oils was measured in a temperature range between -40°C and 60°C. Furthermore, the influence of the HC addition to CO₂ on the tribological properties of PAG and POE lubricants, and the compatibility with metals, elastomers and plastics were tested.