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Enhancing Vehicle Efficiency Through Vapor Absorption Refrigeration Systems

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Abstract : This paper explores the utilization of vapor absorption refrigeration systems (VARS) as an alternative to the conventional vapor compression refrigerant systems (VCRS) in vehicle air conditioning (AC) systems. Currently, most vehicles employ VCRS, which relies on engine power to drive the compressor, leading to additional fuel consumption. In contrast, VARS harnesses low-grade heat, specifically from the exhaust of high-power internal combustion engines, reducing the burden on the vehicle's engine. The historical development of vapor absorption technology is outlined, dating back to Michael Faraday's discovery in 1824 and the subsequent creation of the first vapor absorption refrigeration machine by Ferdinand Carre in 1860. The paper delves into the fundamental principles of VARS, emphasizing the replacement of mechanical processes with physicochemical interactions, utilizing heat rather than mechanical work. The study compares the basic concepts of the current vapor compression systems with the proposed vapor absorption systems, highlighting the efficiency gains achieved by eliminating the need for engine-driven compressors. The vapor absorption refrigeration cycle (VARC) is detailed, focusing on the generator's role in separating and vaporizing ammonia, chosen for its low-temperature evaporation characteristics. The project's statement underscores the need for increased efficiency in vehicle AC systems beyond the limitations of VCRS. By introducing VARS, driven by low-grade heat, the paper advocates for a reduction in engine power consumption and, consequently, a decrease in fuel usage. This research contributes to the ongoing efforts to enhance sustainability and efficiency in automotive climate control systems.

Keywords : VCRS, VARS, efficiency, sustainability
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