Status: Filled

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Project Description

Fuel consumption in vehicles has dramatically increased since 1960s and that results in air pollution and negative environmental impacts. In an automotive air conditioning (A/C) system, the compressor of a vapour compression refrigeration cycle (VCRC) can add up to 5-6 kW of load to an internal combustion engine (ICE) and that power is equivalent to the one required for a 1200-kg sedan cruising at 60 km/h. More than 75% of fuel energy in the ICE is wasted through different ways, such as friction, heat dissipation from radiator and engine cover, and exhaust gas. One of the emerging systems which has the potential of replacing the VCRC is the adsorption cooling system (ACS) in which the adsorber beds replace the compressor of the VCRC. The adsorption cooling system uses exhaust gas, which is a low grade thermal waste, as an energy source to heat up the adsorber beds. The working pairs of the ACS consist of a solid sorbent material, called adsorbent, such as activated carbon, silica gel and zeolite, and a refrigerant, called adsorbate, such as water and methanol. These pairs are environmentally friendly, non-toxic, non-corrosive, and inexpensive. Moreover, the ACS is noiseless, and has no moving parts; however, its mass production represents a challenge because it is a bulky and a heavy weight system. To this end, we are building a lab-scale single-bed ACS at LAEC to study the effects of different parameters such as the adsorber bed types and sizes, working pairs, cycle times, and operating pressures and temperatures. Finally, the ACS should be redesigned as compact as possible to enable it to be used in vehicles.

- Mechanical aspects of the project:

The lab-scale ACS, is about 80% built and the students will participate in assembling, charging, running and testing the system. It is expected that this segment of the project to be completed by the end of January, 2013. Depending on the progress of the project, the ACS is to be modified by replacing the adsorber bed(s), condenser, and evaporator to improve the performance of the system.

- Electrical aspects of the project:

Students are to design a smart controller for the ACS to find the optimized cycle time and improve overall performance of system under different operating conditions. This part of the project is expected to be finalized by the end of March, 2013. In addition, students are to devise an electrical circuit to control temperature of the heat source based on a user-defined schedule to figure out the effects of variable heat source temperature on the performance of the ACS.