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EXPERIMENTAL INVESTIGATION OF EXHAUST HEAT RECOVERY IN PETROL ENGINE USING NANO ENHANCED PCM

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ABSTRACT

About thirty percentage of the heat released during combustion process is carried away by the exhaust gas formed inside the internal combustion engine. This waste heat can be extracted through exhaust gas recirculation system, and can be utilized to do some useful work. In this experiment, waste heat from a multi-cylinder four-stroke petrol engine is recovered using a heat exchanger along with a thermal energy storage tank. Exhaust gases require larger area for better heat transfer since they have low surface convective heat transfer coefficient. So, a shell and tube heat exchanger is used to extract the sensible heat from the exhaust gas. Water flowing through this heat exchanger becomes the sensible heat storage medium. Latent heat from the exhaust gas is extracted through PCM contained in the thermal storage tank. Organic PCM like paraffin is one of the most commonly used material in thermal storage tank due to its thermal stability and non-corrosive properties. Paraffinis kept in cylindrical capsules within the thermal storage tank which is insulated with glass wool covered with aluminium cladding. Since thermal conductivity of paraffin is 0.24 W/mK to enhance its thermal properties, Aluminium oxide nanoparticles having thermal conductivity of 36 W/mK is added to it. Simple direct synthesis method is used for uniformly mixing Al_2O_3 nanoparticles with paraffin. 1.0 weight percentage of Al_2O_3 nanoparticles are dispersed in their paraffin medium by using an ultrasonicator. Experiments are conducted at half load condition and temperature variations are measured using a K-type thermocouple. First set of trials are done with only paraffin and the second set of trials are done with Al_2O_3 nanoparticle enhanced paraffin wax. The heat recovered from the exhaust gas, heat lost and energy saved etc is the parameters which are evaluated. Variation of temperature in the tank, charging efficiency, rate of charging and heat loss coefficient is calculated from the obtained values. From the results, it is observed that more charging efficiency and heat transfer rate is obtained in case of nano-enhanced PCM. Heat loss coefficient is also lower for nano enhanced PCM, hence it can be concluded that nano enhanced PCM is able to store heat energy for a longer duration.

KEYWORDS: Exhaust Gas Heat Recovery, Nano – Enhanced PCM & Heat Utilization Methods

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