ABSTRACT

In a naturally-aspirated diesel engine, only 25% of the heat input is converted into work. About an equal amount of heat is carried away by the cooling system and the remaining heat is lost in exhaust and friction. Reducing the heat transfer to the coolant increases the energy in the combustion gases. Additional power and improved efficiency may be derived from this concept by adopting suitable means of recovering heat from the cooling system. The useful work output increases from 35.3% to 41.01% in the case of LHR engines as compared to standard engines. The heat carried away by the exhaust gases increased from 38.72% to 58.99% in the case of LHR engines than standard engines. The main objective of this work is to simulate the thermodynamic processes of the diesel engine by incorporating a thermal barrier coating on the combustion chamber surface. Due to the adiabatic nature of the engine, the average gas temperature of the cycle and surface temperature increase substantially. Consequently, a high rate of pressure and the peak pressure in the cylinder are obtained. The overall thermal efficiency of the engine is also improved.

A mathematical model has been developed to study the effect of insulating the engine components, on the engine performance of a 4 stroke, single cylinder, naturally aspirated direct injection diesel engine. The model simulates the complete thermodynamic processes of the diesel engine. It includes a detailed gas flow model, and a heat transfer model which evaluate the engine performance after it reaches steady-state conditions.

The available experimental results were used to validate the model. A comparison of the results obtained from the mathematical model with experimental results have shown a close agreement.