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Modeling and Transient Thermal Analysis of the Ic Engine Exhaust Valve

1.PotruGirish*, 2.Dr.M.Janardhan, 3.Mr.G.Rameshbabu*****

*M.Tech Student**professor&Principal ***Associate Professor

Department of Mechanical Engg. Abdul Kalam Institute Of Technological Sciences, Kothagudem,Khammam (DT) -507120

ABSTARCT:

Internal combustion engines produce exhaust gases at high temperatures and pressures as well. These hot gases also pass through the exhaust valve, and the temperature valve, the valve seat, the power increase. To avoid any damage to the Association of the exhaust valve, and the heat is transferred from the exhaust valve through the different parts, especially the inclusion of the valve seat during the cycle of opening and closing because contact each. In this article, it is of limited use element method for modeling the exhaust valve transient thermal analysis. They are obtained from the temperature distribution, heat and resulting pressure in both opening and closing. It conducts detailed analysis to estimate the boundary conditions of the internal combustion engine. The model includes the exhaust valve seat, manual, and spring. Analysis continues until the steady state of the state. In this study, ANSYS and works for modeling and analysis of the exhaust valve. It has been the development of a methodology for analyzing the thermal transient of the exhaust valve.

INTRODUCTION:

With the depletion of conventional sources of fuel at a tremendous rate and increasing environmental pollution it has stimulated extensive research on alternative fuels and engine design. Development work oriented good fuel economy and low consumption of exhaust emissions often change the operating parameters, which is time and money consuming method. Instead of a simulation engine with a mathematical model it can easily be done to evaluate the effects of design changes in the operating parameters in a short period of time and inexpensive device. Modeling is a simple representation of complex real-world problem. Almost all real-world phenomena are complex and may take some simplifications. It is required to develop the simplest possible model, which includes the main features of this interesting phenomenon. Many models have been developed by many researchers to solve the combustion process is a complex homogeneous diesel [1-5]. Due to the complexity of engine operations and understanding it is not enough at a basic level, most incomplete engine models. The models used for design purposes, a complete understanding of the operations

and to predict the behavior over a wide range of engine operating conditions. Theoretical models used in the case of internal combustion engines can be classified into two main groups: thermal models and models of fluid dynamics. Thermal models are mainly based on the first law of thermodynamics are used to analyze the performance characteristics of the engines. The pressure, temperature and other conditions necessary for the evaluation of crank angle or time characteristics.engine friction and heat transfer is taken into account using The mathematical equations that were obtained from the experiments. These models are classified into two groups of an area, multizone models and models. On the other hand, multi-zone models also computational fluid dynamics models is called. They are based on a numerical calculation of the equations of mass, momentum and energy and the preservation of species in any one or two or three dimensions for following the spread of flame or combustion front inside the combustion chamber of the engine. Two zone model is the burn area is one containing the pure air and the other consists of products of fuel combustion and calls burn area. And apply the first law of thermodynamics and equations of state in each of the two regions for the production of cylinder temperature and the change of the cylinder pressure. Using the model of two combustion zones has been the determination of the parameters of combustion and the formation of chemical imbalance. multidimensional models need information in detail many of the phenomena and calculating a timeline. A simple model area but does not account for the heterogeneity of diesel engines. Therefore, it is reasonable to choose the Bmntqtin model are simple and require a reasonably computer time. Defines biodiesel as fatty acid monoalkyl esters derived long chain vegetable oils or animal fats. It was observed from the literature [6-8] that the use of biodiesel in diesel engine results in a slight decrease in the strength of the brakes and a slight increase in fuel consumption. However, the lubricating properties of biodiesel are better than diesel fuel, which can help increase engine life. Exhaust emissions also less clean diesel biodiesel due to the presence of oxygen in the molecular structure of biodiesel process. Moreover, biodiesel is environmentally friendly, since biodiesel does not produce sulfur oxides and also that no increase in CO2 emissions worldwide.

LITERATURE REVIEW:

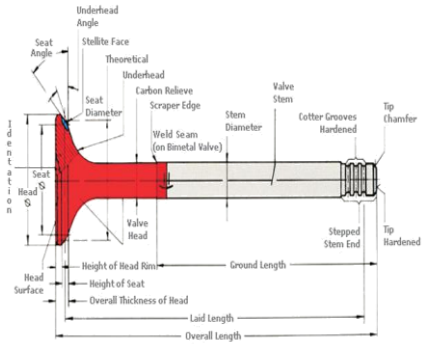
The rapid development of computer technology and the use of complex simulation techniques to measure the impact of the basic processes of engine

systems has encouraged. Progress through the current car engines have achieved would have been impossible without simulation models that offer these ideas [10-11] .Lyn and others. [12] analyzed the effects of the injection timing and the injection rate and fuel rate of the duration of the delay. A constant load increase speed increases the maximum pressure and temperature, due to reduced heat transfer, resulting in a slight decrease in the analysis period delay by Wong et al. [13]. semi-empirical relationship engineering applications based on a series of chemical reactions called also used "s work to find a firing rate [14-15]. But Weibe" Weibe employment picture is not able to predict the rate of fire during the first burning mixture. And therefore does not have to be twice Weibe "accurate direct fuel injection diesel predict function s [14,16]. Biodiesel has a relatively low flash point, high heating value, high density similar to that of petroleum diesel high viscosity. Several studies indicate that unburned hydrocarbons (HC) and carbon monoxide (CO) and sulfur levels are much lower in the exhaust gases while using bio-diesel fuel. However, a marked increase in the levels of nitrogen oxides and Male (NOx) with biodiesel [17-20]. The mixture of biodiesel reduces greenhouse gases such as CO2 levels. Additional benefits include exceptional lubricity, excellent biodegradability, high combustion efficiency and low toxicity compared to other fuels. [twenty-one] The combustion process in diesel engines are very complex due to the nature of the transient combustion and inhomogeneous, which is controlled mainly by the swirling fuel and air. High-speed photography studios and sample collection infrastructure cylinder has revealed some interesting phenomena of the combustion characteristics [10]. ignition delay in diesel engines has a direct impact on the efficiency of engine noise and exhaust emissions. There are a number of parameters that directly affect the identity of the period, including the cylinder pressure and temperature, the ratio of the spiral and misfire. The number of links used Arrhenius expression similar to Wolfer [22] proposed in 1938 as ignition delay is measured as a function of pressure and temperature. Watson [16] developed link identity by a diesel engine under the state of stability which is still used on a large scale conditions. Later Assanis and others.God. [23] developed a delayed start link to predict a delay in turbo direct injection of heavy diesel operating under steady engine and transient operation.

METHODOLOGY:

The valves used in the IC engines are of three types: Poppet, mushroom valve, Sleeve valve or Rotary valve. Of these

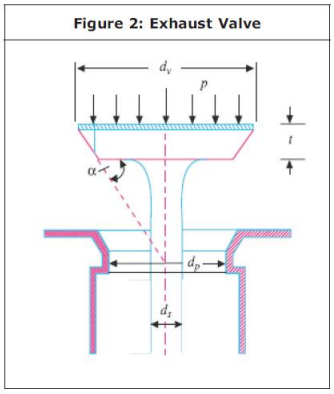
three types, Poppet valve is most commonly used. Since both the inlet and exhaust valves are subjected to high temperatures of 1930°C to 2200°C during the power stroke, therefore, it is necessary that the materials of the valves should withstand these temperatures. The temperature at the inlet valve is less compared to exhaust valve. Thus the inlet valve is generally made of nickel chromium alloy steel and exhaust valve is made of silchrome steel.



About Valves Engine Valve is one of the main parts which are used in all IC Engines. Each cylinder inthe engine has one inlet and one exhaust valve. Now a days engine are designed with multi valves viz., two inlet and one exhaust or Two inlet and Two exhaust valves which prevents air pollution and improves engine efficiency. Function of Inlet Valve The inlet which operates by the action of Tappet movement, allows air and fuel mixture into the cylinder. Function of Exhaust Valve The exhaust valve allows burnt gases to escape from the cylinder to atmosphere. Valve Efficiency Depends on the following characteristics like Hardness, Face roundness and sliding properties capable to withstand high temperature etc.

Design Calculations of Exhaust Valve

Figure 2: Exhaust Valve



Description of the Physical System

The geometry of the exhaust valve is shownin Figure . The exhaust valve sits on thecylinder head of a combustion chamber. Theengine coolant liquid passes around thecylinder liner and the water passages in the cylinder head. The valve pops up and downto let the exhaust gases leave the combustionchamber.The up-and-down motion of the valvetakes place with the help of a rocker leverwhich is connected to the push rod. The pushrod rests over cams on the camshaft. Thevalve is spring loaded. The spring keeps thevalve connected to the camshaft during itsmotion. After the expansion process, theexhaust gases, at high temperature, arepurged through the exhaust valve and as aresult the temperature of the exhaust valveincreases. In order to avoid any damage tothe exhaust valve due to this hightemperature, heat must be

continuouslytaken away from the valve. This is achievedwhen the valve is in contact with its seat. Asthe exhaust valves touch its seat, a significantdrop in exhaust valve temperature occurs.

Pressure-crank angle diagram

Figure 2 shows the measured and computed pressure trace and crank angle histories for the fuels tested at full load condition. In a compression ignition engine, cylinder pressure depends on the burned fuel fraction during the premixed burning phase which is the initial stage of combustion and the ability of the fuel to mix well with air and burn. High peak pressure and maximum rate of pressure rise are corresponding to large amount of fuel burned in premixed stage.

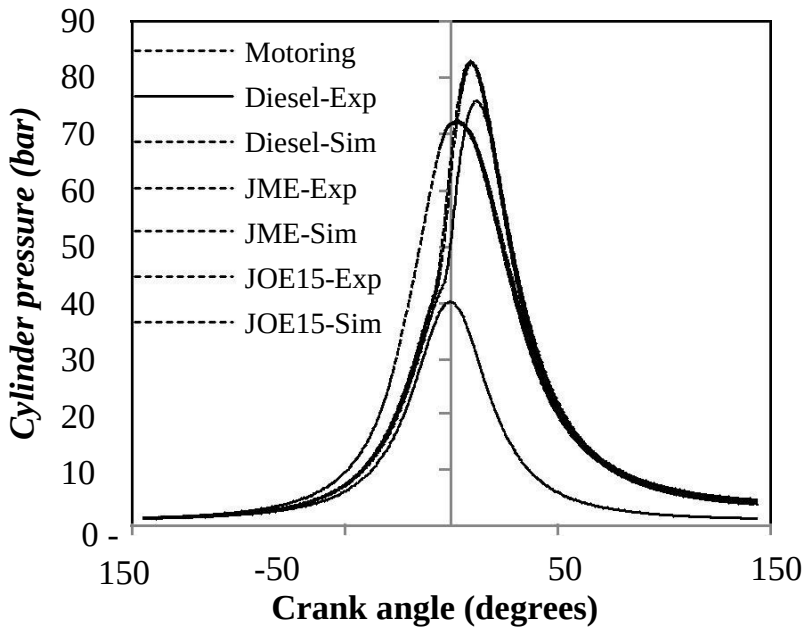


Figure 2: Variation of cylinder pressure with crank angle at full load.

It is observed from the experimental results that the peak pressure for diesel, JME and JOE15 are 75.72, 82.61 and 82.40 bar respectively. For the simulated conditions the peak pressure values are 71.76, 71.99 and 71.85 bar respectively. In both the cases the combustion of JME

and JOE15 starts earlier than that of diesel fuel. Also the peak cylinder pressure of JME and JOE15 is marginally higher than that of diesel, as a result of high viscosity and low volatility.

Apparent or Net heat release rate

Figure 3 depicts the variation of apparent heat release with respect to crank angle for different fuels tested. The term apparent or net heat release rate is determined by deducting the heat transfer to cylinder walls, crevice volume, blow-by and the fuel injection effects from heat energy liberated by burning the fuel.

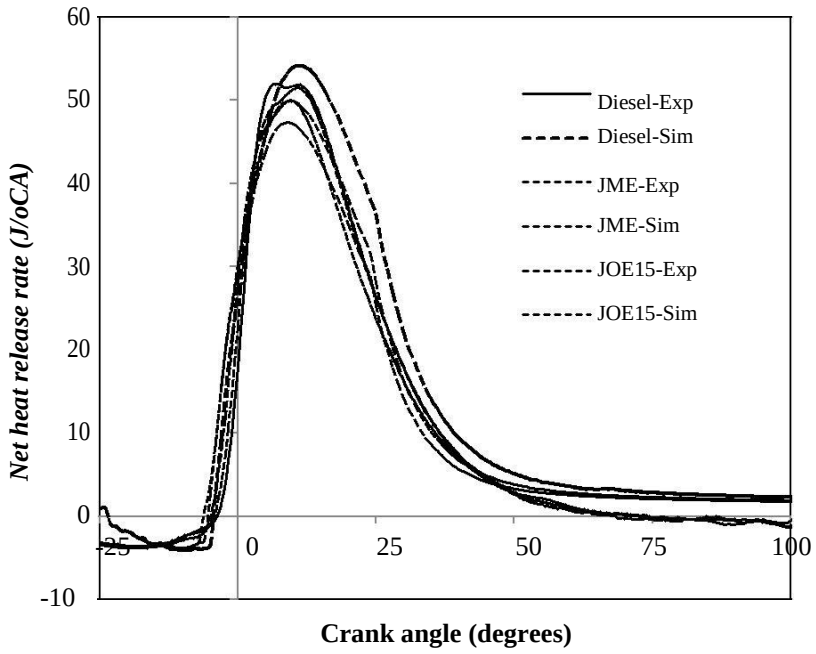


Figure 3: Variation of maximum heat release rate with crank angle.

The experimental results of maximum net heat release rate for diesel, JME and JOE15 are by about 52.01, 49.97 and 48.51 J/^{o}CA respectively at full load condition. At simulated conditions the values are by about 54.20, 49.93 and 47.31 J/^{o}CA for diesel, JME and JOE15 respectively. The intensity of premixed combustion phase for diesel is found to be more and whereas, this is lower in the case JME and JOE15. It is also seen that the quantity of diffusive

combustion are found to be shorter for JME and JOE15 emulsion due to faster burning characteristics. Oxygen present in JME and quick evaporation nature of emulsified fuel JOE15 are the causes for faster burning process [27].

\CONCLUSIONS

- The experimental results of the peak cylinder pressure of JME and JOE15 is marginally higher than that of diesel, and similar results are obtained with simulated conditions.
- The maximum heat release rate of JME and JOE15 are lower than that of diesel fuel in both experimental and simulated conditions.
- The NO emissions of diesel fuel are increased with load both in experimental and simulated conditions. Similar trends have been obtained with JME and JOE15.
- The NO emissions of JOE15 are increased and soot density is decreased with advancing of injection timing and the values are in vice versa in retarded conditions.
- The presented model can predict the combustion and emission characteristics such as cylinder pressure, heat release, NO emissions and soot densities which are in good agreement with the experimental results.

Improper bonding may take place leading to the reduced strength of the component and as a result the component will tend to fail .

If the upset force is less then also the strength of the weld will be less thereby increasing the tendency of the component to fail.8.0 Manufacturing Results.

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