The Analysis Of Thermal Load On Value By Using Mixed Fuels

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ABSTRACT: *The valves utilized in the IC engines are of three types: Poppet or mushroom valve or Sleeve valve or Rotary valve. Of these three sorts, Poppet valve is generally regularly utilized. Since both the inlet and exhaust valves are exposed to high temperatures of 1930°C to 2200°C during the power stroke, in this way, it is fundamental that the materials of the valves ought to withstand these temperatures. The temperature at the inlet valve is less contrasted with exhaust valve. Vehicle motors are normally petroleum, diesel or fuel motors. Oil motors are Spark Ignition motors and diesel motors are Pressure Ignition motors. Mixed powers are blends of conventional and elective powers in shifting rates. In this effect, the impact of petroleum, diesel and mixed energizes on valve is contemplated by numerical connections applying warm loads created amid ignition. As these hot gases go through the fumes valve, temperatures of the valve, valve situate, and stem increment. To maintain a strategic distance from any harm to the fumes valve get together, warm is exchanged from the fumes valve through diverse parts, particularly the valve situate embed amid the opening and shutting out of this world into contact with each other. In this proposal, a limited component technique is utilized for displaying the warm investigation of a exhaust valve. The temperature dispersion and resultant warm burdens are assessed. Point by point investigations are performed to gauge the limit states of an inward ignition motor. In this proposal, Pro/Engineer is utilized for demonstrating and Ansys is utilized for investigation of the fumes valve.*

KEY WORDS: Blended fuels, combustion, exhaust valve, transient thermal.

I.INTRODUCTION

Normally a fossil fuel occurs with an oxidizer (usually air) in a chamber that is an integral part of the working fluid flow circuit. In an internal combustion engine (ICE) the expansion of the high-temperature and high-pressure gases produced by combustion apply direct force to some component of the engine.

The Force is applied typically to pistons, turbine blades, or a nozzle. This force moves the component over a distance, transforming chemical energy into useful mechanical energy. The first commercially successful internal combustion engine was created by Etienne Lenoir. The term internal combustion engine usually refers to an engine in which combustion is intermittent, such as the more familiar four and two-stroke piston engines, along with variants, such as the six-stroke piston engine and the Winkle rotary engine. A second class of internal combustion engines use continuous combustion: gas turbines, jet engines and most rocket engines, each of which are internal combustion engines on the same principle as previously described. The ICE is quite different from external combustion engines, such as steam or Sterling, in which the energy is delivered to a working fluid not consisting of, mixed with, or contaminated by combustion products. Working fluids can be air, hot water, pressurized or even liquid sodium, heated in some kind of boiler. ICEs are usually powered by energy-dense fuels such as gasoline or diesel, liquids derived from fossil fuels. While there are many stationary applications, most ICEs are used in mobile applications and are the dominant power supply for cars, aircraft, and boats.

It is well known that fuel cells operate a chemical reaction which produces electricity and heat making use of the chemical energy of a reluctant agent. The fuel cell modelled in this paper belongs to the polymeric membrane family (PEM) with a nominal power. Fuel cell technology is under development for a range of applications including large scale power generation (MW range), distributed generation of heat and electricity at load centres. The low operating temperature fuel cells such as those based on polymer electrolyte membrane (PEMFC) have rapid start-up and shut-down cycles, excellent load following capability and are ideal for small stationary, portable power and transport applications. However, the downside is the stringent requirements on construction materials, the slow start-up & shut-down time (several hours), limited capability for thermal cycling, significant thermal shielding to avoid heat losses, dissipation of heat if not required, and electrical, thermal load demand management versus operating temperature control. Most fuel cells invariably use gaseous or liquid fuels. A fuel cell technology which has attracted attention only recently (the direct carbon fuel cell) uses solid fuel (carbon) and converts the chemical energy in the carbon to electricity through its direct participation in the fuel cell reactions and electrochemical oxidation.

II. LITERATURE SURVEY

A poppet valve or a mushroom valve is used to control the timing and quantity of gas or vapour flow into an engine. It consists of a hole, usually round or oval, and a tapered plug, usually a disk shape on the end of a shaft also called a valve stem. The portion of the hole where the plug meets with it is referred as the 'seat' or 'valve seat'. The shaft guides the plug portion by sliding through a valve guide. A pressure differential helps to seal the valve in exhaust applications and in intake valves a pressure differential helps open it. From 1770s James Watt used them on his steam engines for the first time. The first successful sleeve valve was patented by Charles Yale Knight, and used twin alternating sliding sleeves. It was used in some luxury automobiles, notably Willys, Daimler, Mercedes- Benz, Minerva, Panhard, Peugeot and AvionsVoisin. The higher oil consumption was heavily outweighed by the quietness of running and the very high mileages without servicing. Early poppet-valve systems required decarbonisation at very low mileages.

The Burt-McCollum sleeve valve was named for the two inventors that applied for similar patents within a few weeks of each other, the Burt system was an open sleeve type, driven from the crankshaft side, while the McCollum design had a sleeve in the head and upper part of the cylinder, and a more complex port arrangement (Source: 'Torque Meter' Magazine, AEHS). The design that entered production was more 'Burt' than 'McCollum,' and was used by the Scottish company Argyll for its cars, and later was adopted by Bristol for its radial aircraft engines, used a single sleeve which rotated around a timing axle set at 90 degrees to the cylinder axis. Mechanically simpler and more rugged, the Burt- McCollum valve had the additional advantage of reducing oil consumption (compared to other sleeve valve designs), while retaining the combustion chambers and big, uncluttered, porting area possible in the Knight system.

A small number of designs used a "cuff" sleeve in the cylinder head instead of the cylinder proper, providing a more "classic" layout compared to traditional poppet valve engines. This design also had the advantage of not having the piston within the sleeve, although in practice this appears to have had little practical value. On the downside, this arrangement limited the size of the ports to that of the cylinder head, whereas in-cylinder sleeves could have much larger port. Biodiesel is a form of diesel fuel manufactured from vegetable oils, animal fats, or recycled restaurant greases by Trans esterification. It is safe, biodegradable, and produces less air pollutants than petroleum-based diesel. y - Duty Diesel Engine the different failure modes affecting the valve failure are discussed. The combination of impact and sliding during the valve closing can lead to valve seat wear. The deposits formed on an exhaust valve are due to the reaction of fuel-borne contaminants and lubricating oil during combustion as well as the reaction of combustion products with valve materials.

The build-up of deposits on the valve face and seat can have an insulating effect that slows cooling and makes the valve run hot and therefore valves can lead to hot corrosion. Another failure mode of valves is fatigue, which may cause the valve to break. Valves usually fail as a result of different failure modes like fatigue, corrosion, wearing and impact which are explained above. The reason for a valve failure may be one of the above explained failure modes or some sort of combination of them. In order to see that combination a failed exhaust valve is examined. It is possible to bring forward following conclusions from the theories well-known and failure modes discussed above. The fractures on the failed valve were observed around the impact area at the table of the failed exhaust valve. Impact area of the valve is exposed to maximum mechanical forces and stresses.

Homogeneous charge compression ignition (HCCI's) auto ignition event is highly sensitive to temperature. The simplest temperature control method uses resistance heaters to vary the inlet temperature, but this approach is too slow to change on a cycle-to-cycle frequency. Another technique is fast thermal management (FTM). It is accomplished by varying the intake charge temperature by mixing hot and cold air streams. It is fast enough to allow cycle-to-cycle control. It is also expensive to implement and has limited bandwidth associated with actuator energy. Exhaust gas is very hot if retained or re-inducted from the previous combustion cycle or cool if recirculated through the intake as in conventional systems. The exhaust has dual effects on HCCI combustion. It dilutes the fresh charge, delaying ignition and reducing the chemical energy and engine output. Hot combustion products conversely increase gas temperature in the cylinder and advance ignition. Control of combustion timing HCCI engines using EGR has been shown experimentally.

III. RELATED WORK

Homogeneous charge compression ignition (HCCI) is a form of internal combustion in which well-mixed fuel and oxidizer (typically air) are compressed to the point of auto-ignition. As in other forms of combustion, this exothermic reaction releases energy that can be transformed in an engine into work and heat. HCCI combines characteristics of conventional gasoline engine and diesel engines. Gasoline engines combine homogeneous charge (HC) with spark ignition (SI), abbreviated as HCSI. Diesel engines combine stratified charge (SC) with compression ignition (CI), abbreviated as SCCI.As in HCSI, HCCI injects fuel during the intake stroke. However, rather than using an electric discharge (spark) to ignite a portion of the mixture, HCCI raises density and temperature by compression until the entire mixture reacts spontaneously.

Stratified charge compression ignition also relies on temperature and density increase resulting from compression. However, it injects fuel later, during the compression stroke. Combustion occurs at the boundary of the fuel and air, producing higher emissions, but allowing a leaner and higher compression burn, producing greater efficiency. Controlling HCCI requires microprocessor control and physical understanding of the ignition process. HCCI designs achieve gasoline engine-like emissions with diesel engine-like efficiency. HCCI engines achieve extremely low levels of Nitrogen oxide emissions (NO x) without a catalytic converter. Unburned hydrocarbon and carbon monoxide emissions still require treatment to meet automotive emission regulations.

Recent research has shown that the hybrid fuels combining different reactivity's (such as gasoline and diesel) can help in controlling HCCI ignition and burn rates. RCCI or Reactivity Controlled Compression Ignition has been demonstrated to provide highly efficient, low emissions operation over wide load and speed ranges HCCI engines have a long history, even though HCCI has not been as widely implemented as spark ignition or diesel injection. It is essentially an Otto combustion cycle. HCCI was popular before electronic spark ignition was used. One example is the hot-bulb engine which used a hot vaporization chamber to help mix fuel with air. The extra heat combined with compression induced the conditions for combustion. Another example is the "diesel" model aircraft engine.

HCCI is more difficult to control than other combustion engines, such as SI and diesel. In a typical gasoline engine, a spark is used to ignite the pre-mixed fuel and air. In Diesel engines, combustion begins when the fuel is injected into pre-compressed air. In both cases, combustion timing is explicitly controlled. In an HCCI engine, however, the homogeneous mixture of fuel and air is compressed and combustion begins whenever sufficient pressure and temperature are reached. This means that no well-defined combustion initiator provides direct control. Engines must be designed so that ignition conditions occur at the desired timing. Two compression ratios are significant. The geometric compression ratio can be changed with a movable plunger at the top of the cylinder head. This system is used in diesel model aircraft engines. The effective compression ratio can be reduced from the geometric ratio by closing the intake valve either very late or very early with variable valve actuation (variable valve timing that enables the Miller cycle). Both approaches require energy to achieve fast response. Additionally, implementation is expensive, but is effective. The effect of compression ratio on HCCI combustion has also been studied extensively.

IV. THERMAL ANYS ON VALAVE USING MIXED FUELS

The most common modern fuels are made up of hydrocarbons and are derived mostly from fossil fuels (petroleum). Fossil fuels include diesel fuel, gasoline and petroleum gas, and the rarer use of propane. Except for the fuel delivery components, most internal combustion engines that are designed for gasoline use can run on natural gas or liquefied petroleum gases without major modifications. Large diesels can run with air mixed with gases and a pilot diesel fuel ignition injection. Liquid and gaseous biofuels, such as soybean oil), ethanol and biodiesel (a form of diesel fuel that is produced from crops that yield triglycerides such can also be used. Engines with appropriate modifications can also run on hydrogen gas, wood gas, or charcoal gas, as well as from so-called producer gas made from other convenient biomass. Recently, experiments have been made with using powdered solid fuels, such as the magnesium injection cycle.

ANSYS is general-purpose finite element analysis (FEA) software package. Finite Element Analysis is a numerical method of deconstructing a complex system into very small pieces (of user- designated size) called elements. The software implements equations that govern the behavior of these elements and solves them all; creating a comprehensive explanation of how the system acts as a whole. These results then can be presented in tabulated or graphical forms. This type of analysis is typically used for the design and optimization of a system far too complex to analyses by hand. Systems that may fit into this category are too complex due to their geometry, scale, or governing equations. ANSYS is the standard FEA teaching tool within the Mechanical Engineering Department at many colleges. ANSYS is also used in Civil and Electrical Engineering, as well as the Physics and Chemistry departments. ANSYS provides a cost-effective way to explore the performance of products or processes in a virtual environment. This type of product development is termed virtual prototyping.

Internal combustion engines such as reciprocating internal combustion engines produce air pollution emissions, due to incomplete combustion of carbonaceous fuel. The main derivatives of the process are carbon dioxide CO 2, water and some soot also called particulate matter (PM). The effects of inhaling particulate matter have been studied in humans and animals and include asthma, lung cancer, cardiovascular issues, and premature death. There are, however, some additional products of the combustion process that include nitrogen oxides and sulfur and some uncombusted hydrocarbons, depending on the operating conditions and the fuel-air ratio. Not all of the fuel is completely consumed by the combustion process; a small amount of fuel is present after combustion, and some of it reacts to form oxygenates, such as formaldehyde or acetaldehyde, or hydrocarbons not originally present in the input fuel mixture. Incomplete combustion usually results from insufficient oxygen to achieve the perfect stoichiometric ratio. The flame is "quenched" by the relatively cool cylinder walls, leaving behind unreached fuel that is expelled with the exhaust. When running at lower speeds, quenching is commonly observed in diesel (compression ignition) engines that run on natural gas. Quenching reduces efficiency and increases knocking, sometimes causing the engine to stall. Incomplete combustion also leads to the production of carbon monoxide (CO). Further chemicals released are benzene and 1, 3-butadiene that are also hazardous air pollutants.

Significant contributions to noise pollution are made by internal combustion engines. Automobile and truck traffic operating on highways and street systems produce noise, as do aircraft flights due to jet noise, particularly supersonic capable aircraft. Rocket engines create the most intense noise. Idling Internal combustion engines continue to consume fuel and emit pollutants when idling so it is desirable to keep periods of idling to a minimum. Many bus companies now instruct drivers to switch off the engine when the bus is waiting at a terminus.

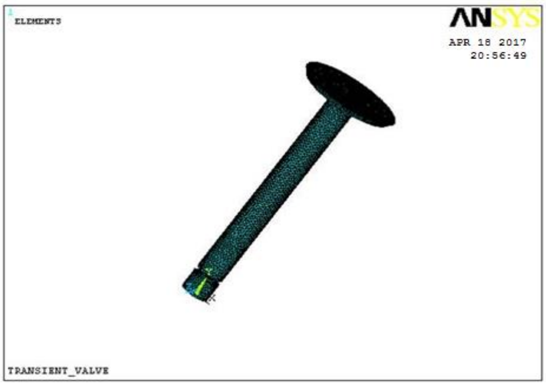

FIG. 1: TRANSIENT RESPONSE OF VALVE SEAT – EN21-4 STEEL

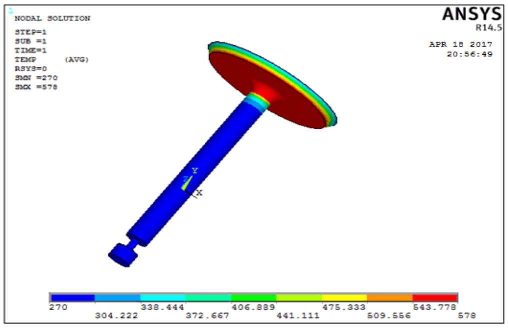

FIG. 2: TEMPERATURE OF VALVE SEAT EN21-4 STEEL

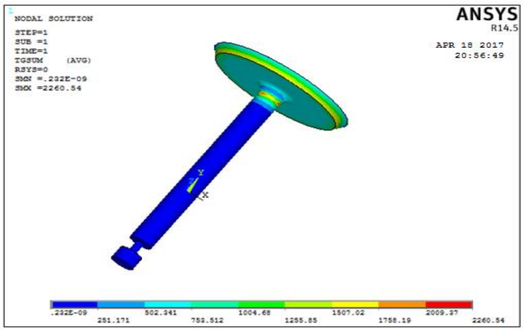

FIG. 3: THERMAL GRADIENT OF VALVE SEAT – EN21-4 STEEL

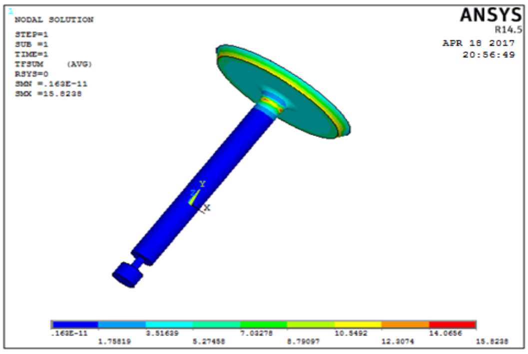

FIG. 4: THERMAL FLUX OF VALVE SEAT – EN21-4 STEEL

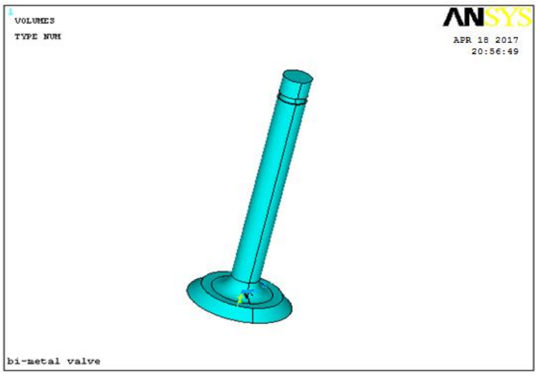

FIG. 5: BI-METAL VALVE OF VALVE SEAT – EN21-4 STEEL

TABLE.1: BI METAL

Material	Temperature	Gradient	Heat flux
EN21-4	578	969.104	29.0781
EN52	578	1227.12	36.814

TABLE.2: SINGLE METAL

Material	Temperature	Gradient	Heat flux
EN21-4	578	2260.54	15.8228
EN52	578	1227.13	36.814

V. CONCLUSION

We designed the diesel engine exhaust valve by using the formulas. We have done the model for the designed model by using Pro/Engineer software. We conducted Transient thermal analysis at closing and opening condition using Bimetal and Single metal for the valve. We have also conducted thermal analysis. Thermal analysis of the exhaust valve shows that the maximum temperature of the exhaust valve occurs at the stem of the valve. By observing thermal analysis results, the results are shown as temperatures are same but heat flux is more for EN 52 material compare to the EN21-4. Here we are observing the results; heat transform rate is more for the EN52 material. So we have to conclude the EN 52 is the best material for valve compare to the EN 21-4. We have also done structural analysis on the valve. The stress valves are both are some but strain will be different. The deformation is more for the EN 52 material.

VI. REFERENCES

[1]. Alvydas Pikūnas, Saugirdas Pukalskas, Juozas Grabys - Influence of composition of gasoline – ethanol blends on parameters of internal combustion engines

[2.] Furey, R.L., Perry, K.L., 1991. Composition and reactivity of fuel vapor emissions from Gasoline-oxygenate blend. SAE Paper 912429.

[3]. Coelho, E.P.D., Moles, C.W., Marco Santos, A.C., Barwick, M., Chiarelli, P.M., 1996. Fuel injection components developed for Brazilian fuels. SAE Paper 962350.

[4]. Naegeli, D.W., Lacey, P.I., Alger, M.J., Endicott, D.L., 1997. Surface corrosion in ethanol fuel pumps. SAE Paper 971648.

[5]. Salih, F.M., Andrews, G.E., 1992. The influence of gasoline/ethanol blends on emissions and fuel economy. SAE Paper 922378, SAE Fuel and Lubricants Meeting.

[6]. Abdel-Rahman, A.A., Osman, M.M., 1997. Experimental investigation on varying the compression ratio of SI engine working under different ethanol–gasoline fuel blends. International Journal of Energy Research 21, 31–40.

[7]. Gorse Jr., R.A., 1992. The effects of methanol/gasoline blends on automobile emissions. SAE Paper 920327.

[8]. Bureika G. Research on the feasibility to use the ethanol as transport machine fuel/ doctoral dissertation. Vilnius. 1997.

[9]. Palmer, F.H., 1986. Vehicle performance of gasoline containing oxygenates. International conference on petroleum based and automotive applications. Institution of Mechanical Engineers Conference Publications, MEP, London, UK, pp. 33–46.

[10]. Bata, R.M., Elord, A.C., Rice, R.W., 1989. Emissions from IC engines fueled with alcohol–gasoline blends: a literature review. Transactions of the ASME 111, 424–431.

[11]. Alexandrian, M., Schwalm, M., 1992. Comparison of ethanol and gasoline as automotive fuels. ASME papers 92- WA/ DE-15.

[12]. Rice, R.W., Sanyal, A.K., Elrod, A.C., Bata, R.M., 1991. Exhaust gas emissions of butanol, ethanol and methanol–gasoline blends. Journal of Engineering for Gas Turbine and Power 113, 337–381.