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MECHANICAL CHARACTERIZATION AND COMPARISON OF GLASS FIBER AND FIBRE REINFORCEMENT WITH ALUMINIUM ALLOY (GFRAA) TO IMPROVE THE STRENGTHENING FOR AUTOMOTIVE APPLICATION

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ABSTRACT

There is a wide spread involvement in the presently graded materials, because of which their major important properties such as resistance to corrosion, high hardness ability, resistance to oxidation and resistance to erosion, stability in thermal and chemical during cryogenic and increased operating temperatures. Such properties makes many application to rely on them for many applications, which including boundary thermal coating (TBC) on metallic and non metallic substrates used at peak temperatures. Thermal barrier coatings has been strongly applied to the internal combustion engine, in peculiar the combustion antechamber for the purpose to simulate adiabatic process. The primary motive is not only for supressing the interior cylinder heat ejection and thermal load fatigue protection of benaeth metallic surfaces, but also for possible reduction of engine waste émissions and consumptiion of brake specific fuel. The relying usage of TBC dimnishes the loss of heat from engine cooling jacket through the channel of surface opened to the heat conduction such as the head of the cylinder, liner, piston ring and piston crown. The protection and performance of the combustion region within the ceramic coating may also affects the combustion activity and, hence, the behaviour of exhaust emissions and performance of the of engine improve. On the other side, the need of supressing the consumption of fuel rate and inflation the engine thermal effectiveness of lead to the adoption of higher compression ratios, in specific for diesel engines, and deflated in cylinder heat ejection.

Key words: Glass Fiber, Fibre Reinforcement, Aluminium Alloy, Automotive

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1. INTRODUCTION

Theoretically whereas the reduction of heat can be supressed, after which the efficiency of thermal would be elevated, only then the range set by the thermodynamics second law can be achived. Less Heat elimination engines designed to attain this by supressing the heat decipated to the coolant. Thermal Coatings in barrier in diesel engine progress to advantages including elevated power density, fuel effectiveness, and multi fuel capability, which leads to increased combustion region temperature Using TBC one can enhance engine power by 8%, supress the specific fuel consumption by 15-20% and elevate the exhaust gasous temperature by 200K.

Eventhough enormous process have been used as TBC for various different purposes, yttria stabilized zirconia with 7-8 wt. Propitionate significant aspects doing vital contribution in thermal boundaries lifetimes which involves heat conduction, thermal, chemical composition stabilization at the service point, high thermo mechanical balancing to the extended service load and nevertheless the coefficient of thermal expansion. The less heat elimination engine has been believed essentially to enhance fuel caution by eradicating the predominent heat removal process and turbocharges the system by exciting the exhaust energy.

2. METHODOLOGY

The methodology includes the process sequentially which carried out, this project includes the process of experiment for the characterization of both coated and un coated in piston material like aluminium specimen by plasma spray methodology with Partially stabilized zirconia.

Theoretically if the heat elimination could be reduced, then at least up to the limit set by the thermodynamics second law, the thermal efficiency would be improved.

The combustion process gets affected due to the ceramic layer coating in the combustion region and, hence, the behaviour of engine, exhaust ejectio and performance is improved.

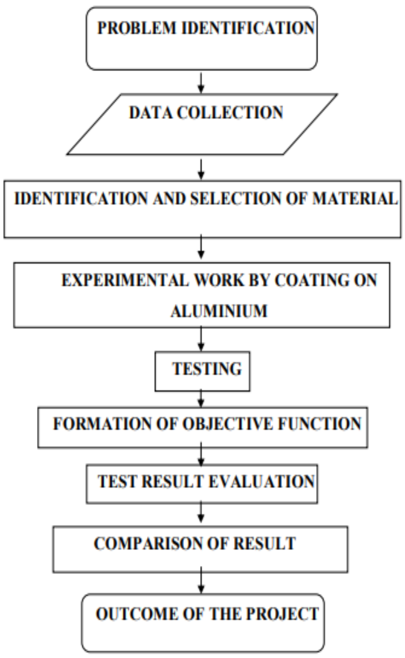

Figure 1 Methodology

3. NANO COATING

Nano-coating is a recently developed technology used for coating any kind of material in hard coating and nano scale coating with low friction resistance at the order of nano. The two major types of nano-coating are 1 .Physical vapour deposition 2.Chemical vapour deposition

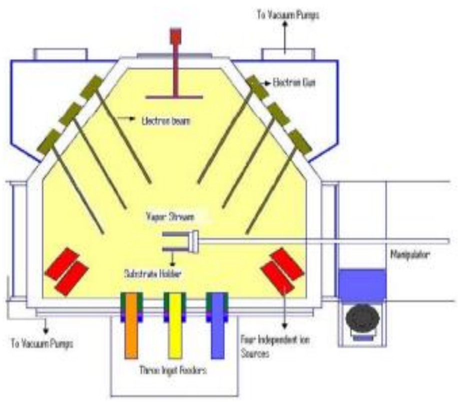

Figure 2 Physical Vapour Deposition

3.1. Physical Vapour Deposition (PVD)

To make deposition at low level and low temperature this PVD process is followed.

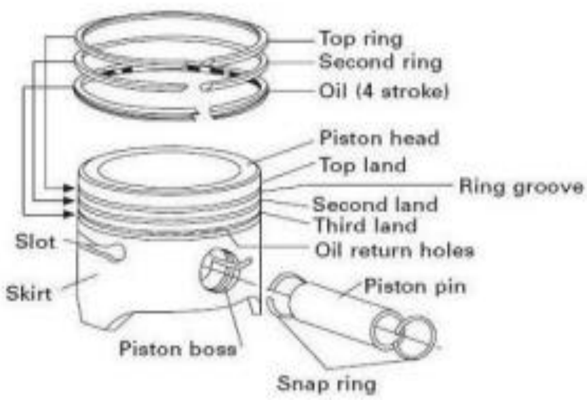

Figure 3 Piston Assembly

The range of zirconia heat barriers. This is recommended for combustion applications. Wear resistant in abrasion up to approx. 900ºC (1650ºF). Coatings resistance welding and corrosive effects of liquid metal. Applied for Valves, Pistion, Troughs coatings for casting molds [5]. Most favourable adoptable for intense thermal barrier function is and resists corrosion from sulphur, chloric acid , sodium,by offering immense resistance. corrosion resistance against sodium, sulfur and chlorine contaminants compared to 8% yttria zirconia coatings Applied to heat boundaries coatings in rocket and jet engine.

3.2. Modeling of Piston

Generally[6] for modeling, packages such as Pro-E, IDEAS will be used. In this analysis the model is created in the ANSA itself to eliminate the data losses that will occur if standard data 18 exchange formats like IGES, STEPS are used. To design the model the details about the key point locations are taken as the inputs.

4. ANSYS EVALUATION

It is pre - owned by engineers planetary in practically all region of engineering[7]. Finite element method is most commonly used through analysis software[8]. The terminology structure (or building) refers not only engineering in civil building structures such as dams, bridges and buildings, yet also Robots, Air plane, and machines and structures such as ships, aeroplane structural bodies, and mounts of machine, as well as other pheripheral elements such as piston rod, and tools.

4.1. Types of Structural Analysis

The analysis of structure were lisited below in the ANSYS region of products are listed and the 7 types aregiven below[4]. The important DOF are estimated in a structural analysis are displacements. Various qualities, such as support, loads, and reaction forces, are then extracted from the nodal displacements[10].

Also Modal Analysis, Harmonic Analysis, Transient Dynamic Analysis, Spectrum Analysis, Buckling Analysis, Static Analysis, Explicit Dynamic Analysis.

4.2. Suitable Element Type

The subsequent element types are available to model layered composite materials: SHELL11, SHELL81, SHELL51, SOLID86, and SOLID191. Which element we choose depends on the application, the type of outcomes that need to be calculated, and so on. BEAM188 and BEAM142, with various multiple material the finite load element is obtained.

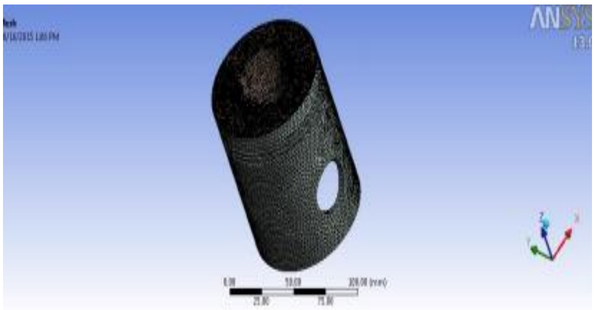

Figure 4 Meshing

5. STEPS INVOLVED FOR CREATING COATING

1. Define element type 1 for coating i.e. shells 93. 2. Define element 2 for solid piston i.e. solid 186. 3. Properties of materials allocated for coating as material model no 1 and define base material as material model no 2 4. Set element as 1 and material model 1 in element attributes. 5. Create area in upper side of piston. 6. Now mesh upper layer. 7. Change element attributes, changes material model as 2 and element as solid 186. 8. Now mesh the solid[9].

5.1. Thermal Analysis

The substructure for load in ANSYS is a heat balance derivation achived from the principle of conservation of energy. The difference in finite method is performed through ANSYS which estimates nodal temperatures, and then uses the nodal temperatures to obtain the other thermal quantities[3]. Only the ANSYS Multi physics, ANSYS Mechanical, ANSYS Professional, and ANSYS FLOTRAN programs support thermal analyses. The ANSYS program handles all three primary modes of heat transfer: conduction, convection, and radiation.

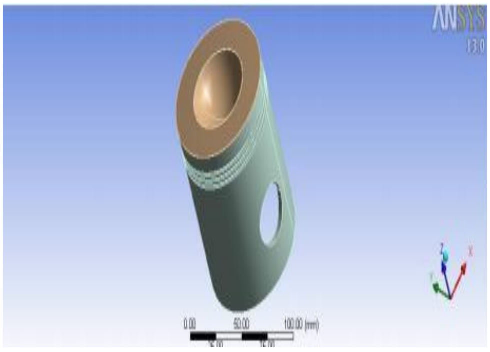

Figure 5 3D Drawing

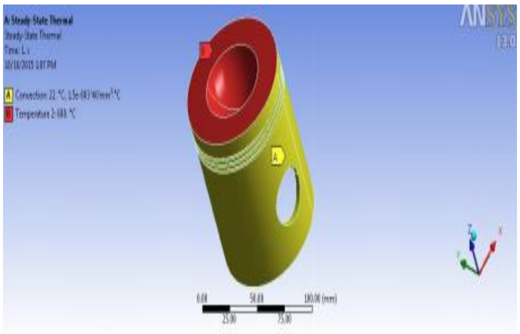

Figure 6 Boundary condition

5.2. Uncoated Aluminium

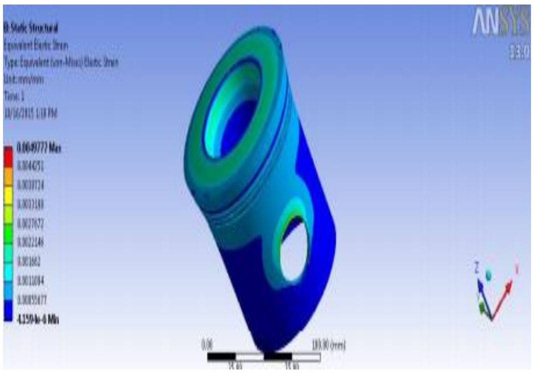

Figure 7 Von – mises stress

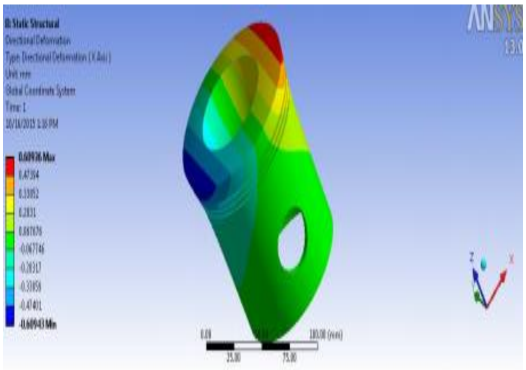

Figure 8 Directional Deformation

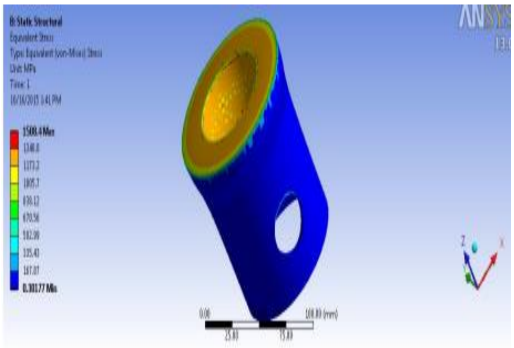

Figure 9 Titanium

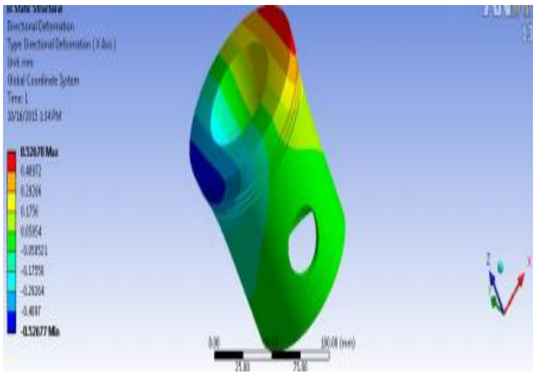

Figure 10 Comparison chart

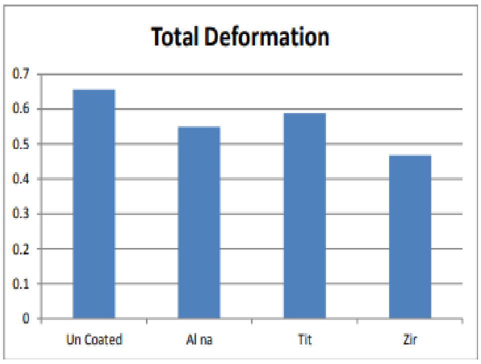

Figure 11 Deformation of Aluminium.

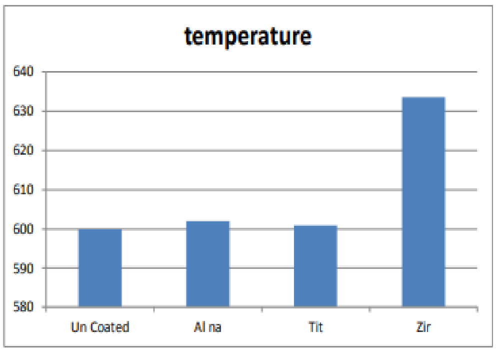

Figure 12 Temperature of Aluminium

6. CONCLUSIONS

From the obtained numerical results the strengthening point of view the Zirconia coated piston strength will be higher than the all other coated piston. So that the tribological property will be increased in terms of wear and thermal barrier also, this will improve the further overall engine efficiency due to the good combustion takes place.On account of more bonding capacity strengthening of the Zirconia coating on the piston surface, the corrosion and wear properties also enormously improved. This will further helpful to complete the incomplete combustion. Additionally from the extracted ansys result, the normal shear and shear stress was found fewer than the remaining coated piston like Titaniaia and alumina. Eventually the temperature distribution is increases for the piston coated with zirconia other than the other available pistons, this will improve the combustion properties and reduces the emissions.

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