STRESS DISTRIBUTION FOR A PISTON WITH A $ZrO_2/20\%Y_2O_3$ TOP LAYER DEPOSITED ON THE PISTON HEADS WHICH ABSORBS GAS PRESSURE

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Abstract: *The forces acting on the piston, in the case of a normal operating regime are inertial forces and pressure force due loosen gases in the combustion chamber. For structural analysis of the piston was considered that it is at TDC and the only force acting on it is due to flue gas pressure. The piston is considered leaning in the bearings and is allowed only after a single axis movement. The method used to determine the state of stress and thermal behavior is the finite element method. For the finite element analysis were conducted CAD models of piston and piston with top layer assembly.*

Keywords: *$ZrO_2/20\%Y_2O_3$, Ansys 13, piston*

1. Introduction

Research in the field of internal combustion aimed at achieving some technological innovations that would lead to a decrease in the manufacturing costs and the maintenance of the engines as well as to reduce fuel consumption. Improving the efficiency of engines through the use of constructive change are rapidly developing at present in parallel with ceramic technology of materials and for the application of ceramic coatings on different areas. To improve the performance of engines, fuel energy must be converted into mechanical energy in a proportion as high as possible. By covering the combustion chamber with a ceramic material which has a low conductive heat transfer coefficient is obtained an increase in temperature and a maximum pressure of heat cycle of an internal combustion engine and all at once an increase in engine output (1).

Research that uses ceramic materials for coating in the field of internal combustion recommends the zirconium oxide thermal barrier and NiCrAl as bond layer (2, 3).

Another study on the use of ceramic materials in the spark-ignition engines has been performed by Mesut, in 2011. It has conducted a study on the practical and mathematical thermal behavior of pistons with ceramic coating.

It concludes that the temperature in the basic material is lower than on pistons without layer and may have a high potential to increase performance and reduce unwanted emissions. (4)

2. Stress analysis using finite element method

CAD models of the piston and of the piston with top layer assembly were designed in order to make the finite element analysis. The respective CAD models were realized in Solidworks and then imported in ANSYS 13, in the Static Structural module in order to determine the stress distribution. The Data Engineering module of the ANSYS 13 program was used to define the piston and deposited layer properties.