ANALYSIS OF THE INFLUENCE OF WORKING TEMPERATURE ON STRESS DISTRIBUTION IN CASE OF PISTON WITH AL2O3 DEPOSITED LAYER

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Abstract: *Given the complex and cyclic stresses that occur in the internal combustion engines piston, it was intended to determine the state of stress that occurs in the piston and the way the presence of a layer deposited on its head influences the stress distribution. Another stress that the piston is subjected to is the thermal stress. The piston head is under intense thermal stress, which may result in uneven thermal deformation. The method used to determine the state of stress and thermal behavior is the finite element method using Ansys software 13.*

Keywords: *Al_2O_3, APS method, Ansys 13*

1. Introduction

In the last 30 years thermal barrier coatings have become essential for a higher life expectancy in the case of IC engines, because the IC engines that are used in auto industry work at high temperatures. The coating has the meaning of isolation, protecting the components from the thermal and mechanical stress phenomenon that appears on the surface while working.

The IC engine works under severe thermal, mechanical and chemical load. The technology of the piston depends on the development of suitable materials that can operate in environments with extreme conditions. Of all the wear factors acting simultaneously the most important is thermal stress. In the case of hot parts of the IC engine, their temperature varies on operating conditions to start, stop, speed, engine off while driving, etc. Successive transition from one operating mode to another leads to changes between 5-20%, in terms of thermal parameters.

The use of such thermal barrier coatings allows increasing the operating temperature without increasing the temperature in the base material and can reduce the quantity of air needed for cooling while maintaining the operating temperature of the engine. At the same time improves the durability and reliability of engine components.

2. Stress analysis using finite element method

In order to have the finite element analysis, CAD models of piston and piston assembly with top layer were conducted. CAD models were designed in Solidworks and then imported into the Structural Static module of ANSYS 13 for determining the distribution of stresses.

Material properties of the piston and deposited layer (such as material properties were considered modulus of elasticity, Poisson's constant, tensile strength and density) were defined in the Engineering Data