



**Politechnika Śląska**

Wydział Transportu



# **PRACA DOKTORSKA**

## **TEMAT:**

*Analiza wpływu warstwy nagaru na wartość  
lokalnych naprężeń termicznych w zaworze  
wylotowym w silniku o zapłonie samoczynnym*

**Promotor:**

dr hab. inż. Piotr Czech  
prof. PŚ

**Promotor pomocniczy:**

dr inż. Aleksander Hornik

**Pracę wykonał:**

mgr inż. Damian Jędrusik

Katowice 2018

## **Summary**

The modern internal combustion engines must meet high requirements regarding: technical and operational parameters, profitability of production and economy of use, environmental protection. One of the basic parameters of operating and technical adequacy is sustainability of the drive unit, which is determined by the size of thermal load of the parts surrounding the combustion chamber. Exceeding the limit values for the thermal loads of elements of the combustion chamber in the engine deteriorates conditions for its operation, reduces its life, and in the extreme cases may lead to its immobilization. The effects of excessive thermal loads are associated with activities of the physico-chemical working medium with high temperature engine parts. Components of the combustion chamber with impact on the durability of the drive unit are the outlet valves, which are among the most heat-bearing parts of the engine. One of the main factors, negatively affecting the modification of the terms of the exchange of heat in the exhaust valves, is carbon deposits.

In this paper, calculations of simulation have been carried out for the purpose of determining distributions of temperature fields and stress values in the exhaust valves, coated with a layer of carbon deposits of the turbocharged compression-ignition engine. The proposed process of computer calculations was meant to allow to specify the impact of layer of carbon deposits in addition to the value and temperature distribution, and in particular the growth of local stresses in the outlet valve in unsteady state, which would complete information about the behavior of these elements during the operation of the drive unit. In addition, the calculations carried out in the work were supposed to be a source of information on how you can simulate the carbon layer on the surfaces of the valve, through the use of computer modeling.

Research material out of which the selection was made to determine the most common cause of formation of damage to the valves were exhaust valves from 52 high-speed diesel engines undergoing maintenance. As a result of the carried out analysis of valve damage to determine how the deployment of carbon deposits on the surfaces of the exhaust valve affected the value of the heat load simulation calculations is selected from two cases of layers of carbon deposits on the surfaces of the valve is: carbon deposits on the valve stem, carbon deposits on the valve stem and on the valve seat and two layer thickness of carbon deposits. The presence of carbon deposits was the result of leak from the engine oil from the top of the head by the sealant on the surfaces of the valve.