Summary

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„Reduction of exhaust valve wear in combustion engines powered by CNG / LNG fuels with the use of Fe - Al intermetallic phases"

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An analysis of the literature on the use of natural gas shows a significant increase in the number of vehicles powered by natural gas, both in road and sea transport. Due to its combustion parameters, natural gas acts to a much more degrading degree on the seat of exhaust valves than conventional liquid fuels. Accelerated valve seat wear leads to a decrease in cylinder compression ratio and requires more frequent valve replacement in a natural gas engine. Therefore, the aim of the work was to develop a method of securing the face of exhaust valves in a CI engine adapted to be fed with natural gas using the Fe_3Al intermetallic phase.

Realizing the assumed goal, a material and technological concept was developed, which included the selection of the type of protective material for the valve seat, the selection of the technology for applying this material and the selection of parameters, including the selection of the binder material geometry and the method of its processing. The adopted concept assumed the creation of a protective layer from the Fe_3Al intermetallic phase by the TIG method on the conical surface of the valve seat. The preliminary tests included the selection of parameters for the production of protective layers free from welding imperfections. The geometry of the binder and the current-voltage parameters of the process as well as its speed were selected. X-ray examinations were carried out in order to qualitatively assess the produced padding welds.

The analysis of the literature and preliminary research allowed to formulate the thesis that **the use of the Fe_3Al intermetallic phase for surfacing the valve seat surfaces of engines in means of transport, adapted to be supplied with CNG / LNG fuel, will increase the durability of the drive unit under operating conditions and will allow for a significant reduction in the frequency of valve lash adjustment** .

In order to prove the thesis, laboratory tests and operational validation tests were carried out. Laboratory tests included tribological tests, hardness measurements and structural tests. The aim of the laboratory tests was to compare the padding weld made of the Fe_3Al intermetallic phase with the Stellite coating, to assess the volume homogeneity of the intermetallic phase padding weld obtained by TIG method, and to determine the abrasive wear resistance properties and repeatability of the obtained results. The results of

macroscopic, microscopic (LM) and microscopic (SEM) metallographic tests as well as X-ray microanalysis confirmed the correctness of the implementation of protective layers on the faces of exhaust valves.

The paper discusses the process of adapting the developed laboratory technology for producing a protective layer to the production conditions. The validation tests were carried out on an engine dynamometer. The positive results of the operational tests made it possible to prove the thesis and were the basis for the patent application no. P.434745 [WIPO ST / 10C PL434745], "A method of increasing the abrasive resistance of the surface of structural elements".