

Experimental Investigation on Effect of the Zirconium + Magnesium Coating of the Piston and Valve of the Single-Cylinder Diesel Engine to the Engine Performance and Emission

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Abstract : The four-stroke single cylinder diesel engine has been used in this study, the pistons and valves of the engine have been stabilized, the aluminum oxide ($\text{Al}_{2}\text{O}_{3}$) in different ratios has been added in the power of zirconium (ZrO_{2}) magnesium oxide (MgO), and has been coated with the plasma spray method. The pistons and valves of the combustion chamber of the engine are coated with 5 different (ZrO_{2} + MgO), (ZrO_{2} + MgO + 25% $\text{Al}_{2}\text{O}_{3}$), (ZrO_{2} + MgO + 50% $\text{Al}_{2}\text{O}_{3}$), (ZrO_{2} + MgO + 75% $\text{Al}_{2}\text{O}_{3}$), ($\text{Al}_{2}\text{O}_{3}$) sample. The material tests have been made for each of the coated engine parts with the scanning electron microscopy (SEM), energy dispersive X-ray spectroscopy (EDX) and X-ray diffraction (XRD) using Cu K α ; radiation surface analysis methods. The engine tests have been repeated for each sample in any electric dynamometer in full power 1600 rpm, 2000 rpm, 2400 rpm and 2800 rpm engine speeds. The material analysis and engine tests have shown that the best performance has been performed with (ZrO_{2} + MgO + 50% $\text{Al}_{2}\text{O}_{3}$). Thus, there is no significant change in HC and Smoke emissions, but NO_x emission is increased, as the engine improves power, torque, specific fuel consumption and CO emissions in the tests made with sample A3.

Keywords : ceramic coating, material characterization, engine performance, exhaust emissions

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