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TITLE

NOVEL INDUSTRIAL PROCESS AND EQUIPMENT FOR WEAR RESISTANT AND ANTIFRICTION COATING OF LARGE DIESEL ENGINE COMPONENTS

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Novel Industrial Process and Equipment for Wear Resistant and Antifriction Coating of Large Diesel Engine Components

Abstract

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1. A Large Area Filtered Arc Deposition System (LAFAD) including a rectangular two-channel macroparticle filter and two rectangular cathodic arc sources allows the production of vacuum coating deposition on articles of complex shape, with practically unlimited height. In this process a pure, strongly ionized gas-metal plasma flow containing multicharged ions without macroparticle impurities is created. The interaction of this plasma flow with the negatively charged substrate results in the deposition of coatings with an amorphous and ultra-microcrystalline structure. These coatings are characterized by a number of unique mechanical properties such as: high microhardness, high corrosion resistance and low friction. This allows the coatings to be used for improving wear resistance of marine diesel parts:

Application of LAFAD equipment allows several surface modifications and coating steps to be performed in one uninterrupted process.

The performance of several vital engine systems has been evaluated as a result of surface modification of parts using the LAFAD system.

1. Combustion subsystems - piston rings and cylinder liners
2. Power transmission subsystems - crankshafts and bearings
3. Fuel distribution - camshafts and valves

Obviously it is difficult to satisfy all demands with one coating material. Therefore, complex, multiphase, multilayer coating technology is being developed for engine part surface modification. The most suitable coating process for piston rings has been found to be a multistage process involving: ion nitriding (≤ 50mm), an intermediate layer of Cr-CrN (≤5 mm) and then an antifriction Mo_2N layer (~ 5 mm). Good results on cylinder liners have been provided by Cr-Si and Cr-Si-N coating systems. The best coatings for crankshafts were diamond-like coatings (DLC) with a thickness of less than 5mm using an Al_2O_3 intermediate layer. Ti -TiN coating systems were found to be most suitable for valve surface modification.

Diesel part surface modification can greatly increase the endurance and ease of maintainence of an engine.

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