

INVESTIGATION OF DLC AND AlCrN - BASED COATINGS USING PVD TECHNIQUE ON AISI-304 & AISI-316 BOILER STEELS WITH RESPECT TO EROSION

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Mode of Study : P. Time

ABSTRACT

The technological development is increasing day by day, so as the energy requirement of ever increasing population of the world. To fulfill the demand of this energy, the power generation therefore required to be speedier and shackle free. Most of the power is generated through the thermal power produced through fossil fuels and among them the major contribution is of coal that is being used for running boilers in thermal power plant across the world. A lot of ash is produced during the burning of coals in the boilers and it has found to be the primary reason behind solid particle erosion of the boiler components. Deposition of advanced protective nano-composite coatings is the most effective and immediate solution for the prevention of erosion. For this particular study, the DLC, AlCrN – based – Monolayer and AlCrN – based – multilayer coatings were selected and deposited on the stainless steels of grade AISI-304 and AISI-316 which are being used to manufacture components of boiler such as boiler tubes. The uncoated as well as as-coated substrates were tested for erosion in the simulated conditions at particle impingement angle of 90° and 30° with air velocity taken as 35 m/s, air temperature as 800°C and sample temperature as 400°C. The results in the form of weight loss were recorded and analysed. The as-coated samples were also tested for the crystal structure using X-Ray diffraction and for surface morphology using SEM/EDAX analysis technique. SEM/EDAX analysis was done to characterize the coatings and used to explain the type of failure i.e. ductile or brittle on the substrates along with other defects produced on surface at different angles of impingement by erodent particles. The results showed that the DLC coating performed better as compared to other coating at 30° particle impingement angle and AlCrN – based – Multilayer performed well as compared to other at 90° particle impingement angle. Overall AlCrN – based multilayer coated substrates outperformed the uncoated and other as-coated substrates. Further, on the comparison of weight loss data during erosion, AISI-316 substrate eroded marginally less as compared to AISI-304 substrate.