A High-Precision Anti-Oxidation Resistance Testing Device for the Wide Temperature Range of an Antioxidant Coating

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Anti-oxidation coatings have been widely used in the fields of aviation, aerospace, energy, and petrochemical, etc. With the deepening of application and research, higher requirements have been put forward to evaluate the performance indices of antioxidant coatings. The oxidation resistance is an important performance index of anti-oxidation coatings, which directly affects both the functional effect and service life of the coating. Therefore, it is of great value to verify the anti-oxidative performance parameters and judge the service ability of the coating. Based on the principle of heat transfer, a high-precision anti-oxidation resistance testing device with a wide temperature range from -180 °C to 2300 °C was designed to assess/evaluate the performance evaluation indices of antioxidant coatings. The device consists of a heating/refrigeration system (including three heating furnaces and a refrigeration furnace), a sample moving system, a high-precision weighing system, and a computer system. Here, an anti-oxidation and thermostable clamp holder are applied to clamp the sample in the heating/refrigeration furnace. The temperature value of the furnace and the specimen is transmitted to the computer system for control, calculation, and storage. The location of the specimen was determined by the computer system via controlling the sample moving system. Furthermore, the oxidation resistance performance evaluation of the anti-oxidation coating can be achieved based on the quality measurement method. The experimental results demonstrate that the device performance is basically stable for evaluating the anti-oxidation performance of coatings, and the uncertainty analysis is also discussed depending on the experimental results. Therefore, the device designed in the present work can be applied to accurately analyze the anti-oxidation performance of coatings and provide a novel route for research on coating properties.