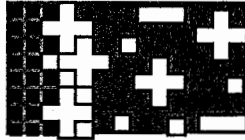


ABSTRACTS



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Effects of Implantation Voltage in Plasma Immersion Ion Implantation of AISI304 Steels

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The surface properties of austenite stainless steels treated by elevated-temperature nitrogen plasma immersion ion implantation depend on treatment conditions such as implantation voltage, sample temperature, and ion dose. In the absence of external heating, the samples are heated only by the energetic ions accelerated by the plasma sheath and implanted into the samples. Hence, the implantation voltage has considerable influence on the resulting surface properties of the treated materials since it dictates the depth of the implanted nitrogen ions and incident ion flux (ion current density). To maintain a constant processing temperature, a higher voltage generally has to be accompanied by a lower average implantation current. Previous results show that high-energy ion bombardment is not always essential in achieving satisfactory surface modification results. In addition, high-energy PIII raises other issues such as more costly power modulators, x-ray shielding, and larger vacuum chambers to accommodate the thicker plasma sheath at high voltage. In this work, we conduct a series of experiments using implantation voltages from 5kV to 20kV to investigate the effects of the sample voltage on the surface properties of treated AISI304 stainless steel materials. To keep the sample temperature constant at 350°C without external heating, the ion flux is adjusted by varying the pulsing frequency, pulse duration, and sometimes plasma density to maintain a constant heat input. The sample temperature is monitored in-situ by a thermocouple integrated into the sample chuck. The thermocouple wires are shielded inside the high voltage feed-through to achieve electrical isolation and arcing immunity even under high voltage operation. The treated samples are characterized by glancing-angle x-ray diffraction, secondary ion mass spectrometry (SIMS), microhardness measurement, and other techniques to evaluate tribological and corrosion properties. Our objective is to identify changes in the structures and surface properties at different biasing voltages at the same temperature and to determine the optimal low-voltage treatment conditions for AISI304 steels.