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ABSTRACTS

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TARGET TEMPERATURE SIMULATION DURING PLASMA IMMERSION ION IMPLANTATION

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The target temperature in the plasma immersion ion implantation (PIII) treatment of metals and semiconductors is crucial as it affects the modified surface properties and structures. An accurate prediction of the target temperature is thus important to PIII processes. We use a two-dimensional fluid model to describe the sheath dynamics when a negative high voltage is imposed on a thin cylindrical target. The equations are solved by the finite difference method to derive the ion distribution, sheath configuration, ion flux to the target, and energy imparted to the substrate by the ions. The calculated heat input is used to predict the temperature rise. The effects of the implantation voltage, pulse duration, pulsing frequency, as well as plasma density on the target temperature will be discussed.

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HIGH FREQUENCY, LOW VOLTAGE PLASMA IMMERSION ION IMPLANTATION OF SS304 STAINLESS STEEL

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Plasma immersion ion implantation (PIII) is an effective technique to produce a thick modified layer in samples possessing an irregular shape. In this paper, we present our special high frequency, low voltage power modulator. The high frequency, low voltage experimental protocols are employed to treat SS304 austenitic stainless steel. Due to the high duty cycle and ion flux, the sample is heated in-situ favoring the treatment process. Analysis of the treated steel samples reveals superior friction, wear, and corrosion properties. This novel technique is especially useful for the surface enhancement of industrial parts with an irregular shape, as the ion-matrix sheath is relatively thin in the low voltage operation and conformal implantation can be more easily achieved.

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CO-IMPLANTATION OF TITANIUM AND NITROGEN FOR SURFACE MODIFICATION OF AUSTENITIC STAINLESS STEEL USING PLASMA IMMERSION ION IMPLANTATION

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Austenitic stainless steels possess excellent corrosion properties and are widely used in the industry. However its low surface hardness being on the order of 200-300 kg/mm^2 and large wear in abrasively stressed parts lead to a short working lifetime. The hardness as well as wear and corrosion behavior of SS304 steels can be improved by nitrogen and titanium plasma immersion ion implantation (PIII). During the process, the nitrogen plasma is ignited by hot filament glow discharge and titanium plasma is simultaneously generated by means of a metal cathodic arc source. Thus, the target in the vacuum chamber is immersed in the plasma and the non-line-of-sight capability of PIII enables the processing of large or irregular-shaped specimens. The nitrogen and titanium ions are co-implanted into the target when a negative high voltage is imposed on the sample. Our experimental results