HIGH INTENSITY PLASMA IMMERSION METAL ION BEAM SOURCE FOR SURFACE MODIFICATION OF MATERIALS

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The results of investigation on development of the vacuum arc discharge based high current low ion energy repetitively pulsed ion source for surface modification of materials are presented. DC vacuum arc was used to produce metal plasma flow. Plasma immersion approach was used for high frequency short pulse metal ion beams formation. A grid semispheres with a radii 7.5 and 10.5 cm, and a cell size 1.8×1.8 mm^2 with transparency 0.7 were immersed in titanium vacuum arc plasma.

High frequency short pulse negative bias amplitude in the range of 1–2.6 kV, pulse duration in the range of 2–8 μs, pulse repetition rate 105 pulse per second were applied to the grid for ion beam extraction, formation and focusing. Repetitively pulsed mode of bias formation provided a possibility to increase the amplitude of bias potential up to several kilovolts and focusing ion beams space charge neutralization.

The influence of bias amplitude, pulse duration and titanium plasma density on parameters of formed ion beam were investigated. Titanium ion beams with a current density up to 1 A/cm^2 and pulsed ion beam power density up to $3 \cdot 108$ Wt/cm^2 were obtained. It was shown that the focusing of ion beams allows multiple reduction of macroparticles and ion beam fluxes ratio. The possibility of macroparticle free high intensity ion beams formation for surface modification of materials are demonstrated. The use of metal ion source for high intensity ion implantation with enhancement of dopant penetration to the greater depth is discussed.

Keywords: *Vacuum arc, Plasma, Ion beams, Repetitively pulsed bias.*