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Medium-frequency microwave plasma immersion ion implantation

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Electron cyclotron resonance (ECR) plasma has been widely used in materials processing due to its high ionization rate and low working pressure. Recently, ECR plasma is also adopted in plasma immersion ion implantation (PIII) because of the demand of a pure plasma and high plasma density in many applications. In this paper, the novel ECR plasma immersion ion implantation device is introduced, which includes a microwave source, permanent magnet resonant cavity and sample vacuum chamber, auxiliary magnetic field system, temperature measuring system, target support, medium-frequency pulse power supply, etc. The typical argon plasma density is from 2 to $9 \times 10^{11}$ cm$^{-3}$ in the resonant cavity and 2 to $5 \times 10^{10}$ cm$^{-3}$ in the sample chamber. Our preliminary experimental results indicate that the medium-frequency microwave PIII is a promising way to form the gradient transition-layer for DLC coatings on Ti-6Al-4V biomaterials.