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HiPIMS Deposition of Nb Coatings with Bias Voltage: Preparation and Characterization at IHEP

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The Nb/Cu film superconducting cavities offer several enhancements over traditional bulk niobium RF cavities, including improved mechanical and thermal stability, as well as a reduced sensitivity to DC magnetic fields. Despite these advantages, Nb/Cu film cavities produced via DC magnetron sputtering often exhibit a pronounced Q-slope issue, potentially due to the low-energy deposition process. In contrast, high power impulse magnetron sputtering (HiPIMS) allows for greater peak power by employing a small duty cycle, to generate a higher ionization rates of target atoms, which in turn can control the deposition energy of the particles through the substrate bias voltage adjustments, thereby improving film quality. Therefore, we developed the application of HiPIMS with bias voltage for the preparation of Nb films by adding a cylindrical mesh as an anode on the previous 1.3 GHz dummy cavity coating system.

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