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The field emission current density from a metal in the presence of field emitting nanotips on the surface in accelerating structures

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Field emission is one of the main factors, which leads to the loss of electrical insulating properties of the interelectrode vacuum gap. Solving the problem of reducing the field emission current value in accelerating structures is necessary to obtain gradient-stable materials before the occurrence of dark currents and, as a consequence, the possibility of overcoming high-vacuum high-gradient breakdowns.
The increasing of the field emission current value in high-gradient accelerating structures is due to the following main factors: suppression of the work function of metal; irregularities on the metal surface in the form of nanoscopic tips.
In the presence of an electric field strength E near the nanoscale tip on the metal surface, the local electric field strength increases, which leads to an increasing of the field electron emission current value. Therefore, it is important to substantiate the parameters of the metal surface roughness using the generalized enhancement factor β of the electrode surface.
The purpose of this study is to calculate the field emission current density from the surface of high-gradient accelerating structures, taking into account the model of continuous uniform distribution of hemispherical nanotips on the copper surface.

Topic

Field Emission

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