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On the role of microprotrusions in high gradient structures¹

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LABORATION — The RF breakdown is a phenomenon critical for operation of high-gradient accelerating structures. One of possible reasons for the breakdown is the ohmic heating of microprotrusions on structure surfaces due to the field emitted electron current. In long enough pulses this heating may result in the protrusion melting. In this work we present the study of the heating of protrusion. We use point charge model model in connection with Fowler Nordheim equation to obtain the solution to the electric field potential and current density outside the protrusion and then linking those quantities to obtain solution for electric field and current density inside the asperity. These quantities were used for studying the heat propagation inside the protrusion and calculating the temperature rise in the structure. The shape of the protrusion and the material of which the RF cavity is made are the parameters that can be varied during the simulation. Strong dependence of the time required to heat up protrusion to melting point on the amplification factor is reported.

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