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Large Volume Plasma Production in SRF Cavities with Complex Geometrical Shape JANARDAN UPADHYAY, JOSEPH NEWTON, ALEX GODUNOV, SVETOZAR POPOVIC, LEPSHA VUSKOVIC, Old Dominion University
— Plasma based surface modification is the only technology with promises of in situ processing of superconducting radio frequency (SRF) cavities. These are the electrodynamically resonant components of complex shape, such as accelerating, deflecting, or "crabbing" cavities. Each shape is optimized for the electromagnetic field distribution that is needed to achieve a particularly required performance. As a result, cavity geometry is quite complex at a relatively large volume that is 5-10 liters, approximately. Hence, to create uniform plasma with varying pressure range at the resonant frequency is a nontrivial task. In this work, a simplified model of resonant microwave breakdown and the sustained plasma is developed with the goal to maximize plasma uniformity over the cavity structure. Its results are compared with the experimental results for a 1.5 GHz multiple cell accelerating structure. The model is based on the macroscopic plasma approach and the results were evaluated for the room temperature, non-superconducting conditions. We will discuss conditions and consequences of two cases, where free and ambipolar diffusion are dominant. Besides the symmetrical accelerating structures, the model for more complex, asymmetric, cavities is being developed and will be discussed.

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