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Investigating the Physics of Microwave Induced Breakdown in Metamaterials with Multi-Resonant Constituting Unit Cells CHIEN-HAO LIU, JOEL NEHER, JOHN BOOSKE, NADER BEHDAD, University of Wisconsin-Madison — Recently, metamaterials are receiving significant attention in the high-power microwave area for applications ranging from amplifier design to HPM spatial filters. In this work, we investigate the impact of microwave-induced breakdown on the responses of high-power metamaterials that exploit multi-resonant constituting unit cells. We recently demonstrated a single-layer metasurface, the unit cell of which consisted of two different resonators, that showed a discrete nonlinear response under HPM illumination. We observed that when breakdown occurred in this structure, both resonators break down simultaneously despite their considerably different expected breakdown power levels. In this structure, breakdown in the resonator that has a lower breakdown threshold level mitigates the breakdown in the second resonator. In this work, we examine VUV radiation and electron diffusion as potential culprits for this phenomenon. We first will shield the two resonators physically using a VUV transparent material to block possible movement of electrons from one resonator to the other. We will subsequently repeat the same breakdown experiments using a VUV opaque material. The results will be used to determine if either of these potential culprits is responsible for this phenomenon or not.

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