A MAGNETRON USING A FIELD EMISSION CATHODE AND A FACETED GEOMETRY*

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A cylindrical magnetron using Field Emission Arrays (FEAs) is being modeled to determine whether such a device could achieve improved performance. In this approach, field emitters are used to provide a distributed cathode. To protect the emitters from the harsh environment of the magnetron interaction space, the emitters are placed below the interaction space in a shielded structure. The anode to cathode electric field is provided by an electrode containing multiple slits. This sole electrode then defines the interaction space and is subject to both the ion and electron bombardment. The emitters are placed below the slits in a configuration with no line of sight to the interaction space. The electrons are emitted along the surface of the cathode substrate, and an adjacent "pusher" electrode is used to direct the electrons away from the surface and out through the slit in the sole electrode. To allow fabrication of the emitters on flat substrates, the cathode is divided into flat facets to approximate a cylindrical cathode. The magnetron being studied is an L-Band device with a -35kV cathode, 900 G magnetic field, anode radius of 2.2 cm, and cathode radius of 1 cm. Electron trajectory modeling using the code Lorentz2E[1] has been performed to look at the effects of the faceted cathode geometry. This modeling has shown that distorted cycloidal orbits can occur with too few facets. The modeling has shown that using 10 facets provides consistent orbits. The modeling has also been used to design the sole electrode slit and pusher electron configuration. The impact of the faceted cathode geometry upon magnetron dynamics has been investigated using ICEPIC[2], AFRL's 3D electromagnetic particle-in-cell code. ICEPIC calculations are also being used to explore aspects of controlled emission enabled by the use of FEAs. These simulation results will be presented.

1. www.integratedsoft.com
2. Peterkin and Luginsland, Comp. Sci. Engin., **4**, #2, p42 (2002).

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