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Toroidal Electron Source

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Electron beam sources are important for a very broad field of applications. Sterilization of surfaces, irradiation of polymers for degradation, polymerization, grafting and crosslinking, as well as hardening of lacquers and disinfection of seed are an abstract of applications where electron beams are the state of the art.

The penetration depth of accelerated electrons on atmosphere is very limited. The electrons lose their energy on air. To apply an homogeneous dose on 3D shaped products is difficult with existing line emitters or scanners with flat window geometry. State of art is the usage of 2 or 3 line emitters to reach every point of surface on these kind of products.

FEP has developed an innovative toroidal shaped electron emitter that emits electrons to the center of the source. (Figure 1) Base of this source is the splitting of electron generation and electron acceleration into two separate process steps. The first step is the generation of the electrons. A plasma generates ions. The ions hit a cold aluminum cathode. The electrons were generated by ion bombardment of a cold cathode. In the second step the electrons are accelerated by a negative potential on the cold cathode in direction to the electron exit window. The first laboratory machines are designed in ring shape. The inner dimension on atmosphere is 180 mm. Even more difficult shapes or are much taller inner dimensions are possible.

The research and development of initial plasma and the generation of an homogenous electron beam are part of scientific investigations and will be shown on ICARST. FEP will present adjustment of dimensions, pressure and current for reach stable plasma conditions and dosimetric analysis of treated products like 3D shaped SCF tubs that proofs the improvement in comparison to state of the art processes.

Country/Organization invited to participate

Germany

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