Slot-Excited Long Racetrack ECR Plasma Source for Roll-to-Roll (scanning) Processing

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A SLot-excited ANtenna (SLAN) long racetrack ECR plasma source was newly designed and fabricated. The source can be utilized for roll-to-roll plasma processing such as thin film encapsulation of large-area OLED (organic light emitting diode) panel and functioning or modification of fabric surface. The source was designed to be long, sub-millitorr pressure operated, and to have high density uniform plasma. The above features were accomplished by a slot-excited long racetrack ring resonator, toroidal geometry of magnetic field ECR configuration, and reinforced microwave electric distributions around the central region of plasma chamber. Also the source was made to be high-power microwave capable by using a waveguide aperture excitation instead of an insertion rod coupling which has been always problematic in high power operation. It is also designed that plasma profile (uniformity) can be adjustable by a newly employed tail plunger, which was attached to the opposite side of the waveguide aperture in the racetrack ring resonator. Experiments showed successful plasma generation and stable operation in the Ar pressure range of 0.2-10 mTorr with the microwave power of 0.5-3 kW. As expected, the plasma is measured to be uniform (<10 %) in the direction of straight track and to have Gaussian profiles in the direction of scanning direction.

In this presentation, the design features and diagnostic results are mainly described. Further, based on the previous results, a newly designed up-scaled racetrack-SLAN source is given.