A RAPID PLASMA MICROWAVE SWITCH FOR INJECTION LOCKING OF RELATIVISTIC BACKWARD WAVE OSCILLATOR

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The Phase-locking approach of injecting the small external signal into relativistic backward wave oscillator (RBWO) only during oscillation buildup to fix the initial phase of free running is put forward and validated by experiment.[1-2] To enhance the priming effect, multicavity RBWO is applied and a plasma microwave switch is developed.

To support injection of the external signal and isolate the low power input/ high power output microwave, a plasma microwave switch based on dielectric multipactor electrons is proposed. The switch is triggered by itself and no actuator is needed. The switch turn-on time can be achieved several nanoseconds and the power capacity can be achieved tens to hundreds megawatt.

In our experiment, the external signal provide by a prime magnetron source is injected through the open plasma switch into RBWO at its downstream end during oscillation buildup. In this stage, the power of RBWO is so low that the feedback from RBWO to magnetron is absorbed by the isolator. Once the electromagnetic field generated by RBWO grows strong enough to achieve the threshold of switch, the switch is activated to turn off the channel between prime source and RBWO by releasing plasma. The high power output microwave transmits by other channel and radiates to atmosphere by a horn. The time for switching is less than 5 ns. With the injection power of about 400kW, the phase of RBWO is controlled and reliability of the new approach is confirmed.