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Dynamic responses of negative ion meniscus to externally applied RF field

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Dynamic responses of negative ion meniscus to externally applied RF field with 2% arc discharge power were investigated experimentally. Three types of responses were identified. First is the beamlet width oscillation with the same frequency as the applied RF field. The second is the oscillation of the beamlet axis. The third is the response of the time-averaged beamlet width. These responses are different properties observed for the positive ion beamlet, indicating that the meniscus formation mechanism for negative ion beam extraction differs from that for positive ion beam extraction, which is well explained by the Bohm sheath model. The empirical scaling for the amplitude of the beamlet width oscillation was obtained. The beamlet width oscillation is proportional to the externally applied RF field and the slope of the perveance curve. The beamlet Oscillation is recognized to be a linear response of the meniscus. On the other hand, the response of the time-averaged beamlet width is nonlinear, and the higher order of the perturbation should be considered in the beamlet focus model.
Strong frequency dependence of the response of the beamlet width is identified, suggesting that the beamlet response can be mitigated when the RF frequency becomes low.

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