Pseudo self-sputtering condition in a compact confronting planar magnetron device

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Downsizing of a plasma device often causes reduction in electron density as ionization efficiency decreases almost linearly with decreasing distance for ionizing electrons to travel inside of the device. Operation of magnetron discharge in a small volume becomes more difficult when the working gas forms passivating layer on the surface of electrode \cite{1}. However, preparation of a small sample is usually favored as characterization of the material properties requires small sample sizes that make direct insertion of samples into measurement devices possible. Thus, a 12 cm diameter 10 cm long device equipped with two confronting magnetron electrode to hold sputtering materials have been designed and built to test the performance of plasma- sputter thin film deposition onto a deposition sample as small as 2X2 cm\textsuperscript{2}.

When the sputtering targets of the same materials are installed on the confronting magnetron electrodes, the deposition speed becomes larger by 15\% from the case that the device is operated with single magnetron configuration of the same discharge current. This may be attributable to the higher sputtering yield by ions of target material, or the self-sputtering, than the yield due to discharge support gas. Discharge operation with reactive gases like oxygen is currently still unstable, and additional miniature discharge system will be installed to realize stable discharge at low working gas pressure. Operation parameters to realize pseudo self-sputtering condition is currently being investigated to further enhance the deposition rate.