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Fine ion energy control for sub-32 nm node device RIE using pulsed-DC superimposed 100 MHz rf CCP[1]

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1 MHz pulsed-DC superimposed (p-DCS) 100 MHz rf CCP (capacitive coupled plasma) RIE was studied to control the ion bombardment energy precisely. It was found that (a) the input p-DCS 100MHz waveform was reproduced on the wafer, (b) Maximum ion energy of the ion energy distribution could be controlled by the p-DC voltage, and also, about 70% of the total ion flux was concentrated at the maximum ion energy region, which corresponded to the 70% duty ratio of the 1 MHz pulsed-DC, and, (c) a narrow energy width was obtained by 100MHz. Fine ion energy control was realized by p-DCS CCP. The p-DCS CCP was applied to the SOC (spun-on carbon) RIE with SOG (spun-on glass) as mask. It was found that SOC etch rate increased with p-DC voltage, SOG mask erosion was suppressed by maximum ion energy control of p-DCS CCP, and as a result, CD shift was minimized at high etch rate by using p-DCS CCP. The p-DCS 100 MHz rf CCP was effective for sub-32 nm node device RIE.

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