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A novel pulsed biasing approach and its benefits for plasma material processingPavel Kudlacek¹, Rein Rumphorst¹, Richard van de Sanden¹¹Technical University of Eindhoven, Eindhoven, Netherlands

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Nowadays plasma processes, require an improved control of the ion energy distribution function. For instance a precise control over the bombarding ion energy has been reported to be a key to achieve high etch selectivity and it is also well known being crucial factor determining a structure of materials deposited in plasma. Therefore, an additional bias voltage is often applied to the substrate to control the ion energy and/or their flux onto the substrate. Recently, a pulsed bias scheme became subject of increased interest as a promising technique to reach narrow, nearly mono-energetic ion energy distribution (IED), considering that the conventionally used radio frequency (rf) bias leads to a broad inherently bimodal IED. Moreover, in contrast with the pulsed bias, a secondarily generated plasma has been observed while using the rf bias, leading to deterioration of an ion bombardment directionality. Hence, we have introduced a novel pulsed biasing approach, based on an original idea of Wendt et al. [JAP 88, 643 (2000)], and designed a dedicated pulsed power supply to meet requirements for an accurate ion bombardment characteristics control.

Our contribution will discuss benefits of the introduced pulsed biasing approach for control of several plasma processes. Demonstrators of etch processes, such as an etching of deep features into silicon using fluorine-based chemistries and a pure physical etching of Mo, C and Be films by hydrogen ions impact will be mainly shown and discussed. Benefits for a low energy ion treatment and an ion assisted deposition will be mentioned as well.

Keywords

Pulsed bias

Ion assisted etching

Ion assisted deposition

Secondarily generated plasma