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PARTICLE-IN-CELL (PIC) SIMULATION OF PULSED AND QUASI-DC (DIRECT CURRENT) PLASMA IMMERSION ION IMPLANTATION (PIII)

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Plasma immersion ion implantation (PIII) is a useful technique to modify the surface properties of materials and synthesise thin films and it has attracted attention from researchers and engineers in many fields [1-5]. PIII excels in large-area processing because of the high implantation dose rate and instrument simplicity. The obvious advantages are higher sample throughput and lower cost. It is therefore an excellent alternative to conventional beam-line ion implantation in a number of areas pertaining to semiconductor processing, for example, formation of shallow junctions, separation by plasma implantation of oxygen (SPIMOX), and hydrogen-PIII / ion-cut. The typical voltage pulse duration in PIII experiments is on the order of a few tens of microseconds [1,4,5]. Our preliminary results project that a longer pulse width will introduce a number of advantages to the hydrogen PIII / ion-cut and water PIII processes, for instance, reduction of surface hydrogen, metal contamination and implantation-induced damage [6-8]. In this paper, we present a particle-in-cell (PIC) model to simulate pulsed and quasi-DC (direct current) PIII processes and the results. The quasi-DC mode utilizes pulse widths that are a factor of ten or more longer than the results that used in typical pulsed PIII. DC PIII is in fact the limiting case when the pulsing frequency approaches infinity, i.e., a single infinitely long voltage pulse.

References

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