Analysis of the effect of targeterosion magnetron sputtering on deposition profile using 2D and 3Dparticle-in-cell simulation combined with a ghost fluid method

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Magnetron sputtering is widely used in industrial applications requiring thin film formation at low deposition temperature. In this apparatus, the target has a limited lifetime since the surface of the target is sputtered and eroded. Moreover, the eroded target induces a change in the deposition profile, and the characteristics of the thin film are deteriorated. To analyze this phenomenon, we included the effect of the change in target surface by sputtering using a particle-in-cell (PIC) simulation combined with a ghost fluid method. The PIC simulation follows the dynamics of each particle under nonuniform magnetic and electric fields, and it can simulate the sputtering phenomenon by ions with the energy and angle distributions. The PIC simulation code was parallelized using OpenMP to reduce computation time. For the eroded target surface, a ghost grid is used to calculate the potential profiles using the curve boundary. In this presentation, we compare 2D simulation results with 3D simulation results to see if the 2D-PIC simulation results are reasonable. We report the deposition profiles and the incident angles of sputtered particles entering the substrate with the variation of the depth of the target surface.