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Investigation of a pressure gradient Ar plasma sputtering for metal thin film deposition

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Ar plasma sputtering is a well-established thin film deposition technique since Ar gas in process is chemically stable and the mass is heavy enough to sputter metallic atoms from the target. The conventional working pressure is around a Pa or less because of sustaining magnetron plasma and of the decrease collisions between sputtered metallic species and Ar atoms from the target to substrates. However, the low pressure condition is not always good for the sputtering process because such a low pressure is difficult to sustain a stable plasma. In this study, we have investigated a pressure gradient Ar plasma sputtering system for metal thin film deposition. We set an orifice plate between the sputter cathode and the substrate. Ar gas was introduced from the cathode region and evacuated from the substrate region. The ratio of the pressure in the cathode region and that in the substrate region is successfully increased from 1.3 to 2.8 by controlling pumping speed. Using the pressure gradient sputtering, we achieved higher deposition rate which was more than double. The higher pressure in the cathode region maintains the magnetron sputtering and the lower pressure in the substrate region reduces the collision between sputtered atoms and Ar atoms leading to increase the deposition rate. The results shows adding the simple orifice is a promising to increase the deposition rate.
On-site, we will discuss the mechanism of the pressure gradient sputtering deposition

Keywords
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