Atomic Layer Deposition of Yttrium Oxide from Y(^{i}PrCp)$_3$ Precursor and Oxygen with Argon boost

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Introduction

Yttrium oxide (Y_2O_3) caught attraction for a wide range of potential applications due to its material properties, including relatively high permittivity (10-17), wide band gap (~5.5 eV) and high refractive index (~1.8) [1]. Numbers of papers have report atomic layer deposition (ALD) of Y_2O_3 films [2][3], in which Ar bubbling have been utilized to overcome the low vapor pressure of Y precursor. Boost technology is another way to effectively deliver low-vapor-pressure precursor. In this study, we deposited the Y_2O_3 thin films by ALD method with Ar boost technology.

Experiment

Figure 1 shows the gas delivery system in our ALD system. Y_2O_3 thin films were deposited by Y(^{i}PrCp)$_3$ precursor and oxygen remote plasma. The cylinder of the precursor, kept at 140°C, is pressurized by Ar prior to the injection into the chamber. The pressure of the cylinder was controlled by the period of the Ar valve (V_{Ar}).

Results and discussion

Fig. 2 shows the film thickness after 100 cycles on Ar valve period. The growth efficiency increased while increasing the period of Ar valve. That is, higher pressure in the cylinder can efficiently deliver the precursor. At high pressure, the thickness starts to decrease, presumably due to the excess dilution of the precursor. Note that no film was deposited without Ar boost technology.

Conclusion

Y_2O_3 film deposition was performed by Y(^{i}PrCp)$_3$ and Ar boost technology. Pressurization of the cylinder is effective in delivering the precursor into the chamber. However, excess pressurization results in dilution of the precursor, eventually leads to thinner deposition rate.

This work was partly supported by COI program (JST COI (JPMJCE1309)) at Tokyo Institute of Technology.

References

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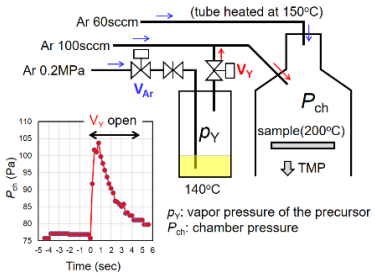

Fig. 1 Gas delivery in our ALD system.

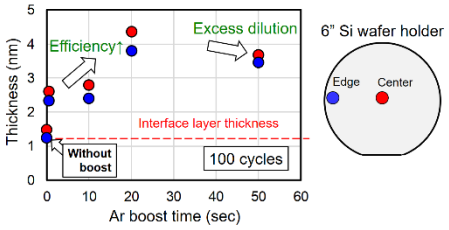

Fig. 2 Thickness of the deposited film after 100 cycles on Ar boost time.