Development of a Novel Method for Resist Removal by Ozone with Acetic Acid Vapor

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Abstract

A novel method of removing the photo-resist using ozone gas with acetic acid vapor for LCD manufacturing has been developed. Glass substrates (size 100×100mm^2) coated with I-line resist were treated under the conditions of substrate temperature (T_S) 27-50℃, acetic acid vapor 2-18 vol.%, ozone 0-9.3 vol.% (0-200g/m^3), total gas flow rate 2 L/min and gas pressure 100kPa. A previous ozone treatment [1-4] with over-saturated water vapor or sprayed water overcame the limitation of ozone diffusion into the resist by the control of a water film condensed on the resist.

In this study, pure acetic acid vapor has been applied to the resist removal by ozone in order to improve the oxidation rate of the resist, because acetic acid is an inactive solvent in the ozonization and the solubility of ozone is much higher than water (**Fig.1**). It was observed that the resist removal rate increased with acetic acid and ozone concentration, and reached at 6μm/min at T_S=50℃, which was about 6 times greater than that of the previous ozone treatment (**Fig.2**). Metal corrosion of molybdenum and aluminum electrodes was found negligible during the ozone treatment with acetic acid vapor (**Fig.3**).

Our method demonstrates the following benefits:

(1) higher removal rate using ozone at lower than 100℃

(2) It reduces the use of chemicals

(3) No metal corrosion during the treatment.

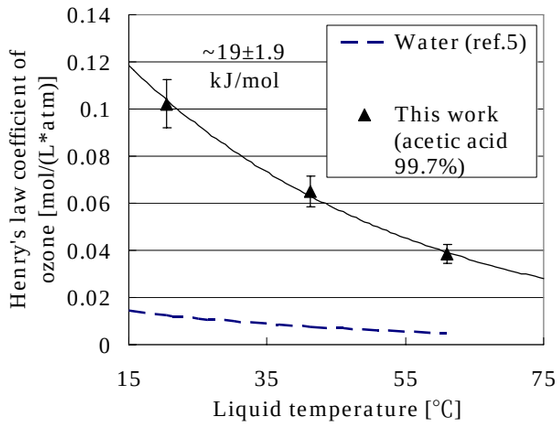

Fig.1 Temperature dependence of the Henry's law coefficient of ozone in acetic acid. ▲ This work (acetic acid 99.7%). The dashed line is the Henry's law coefficient of ozone in water.[5]

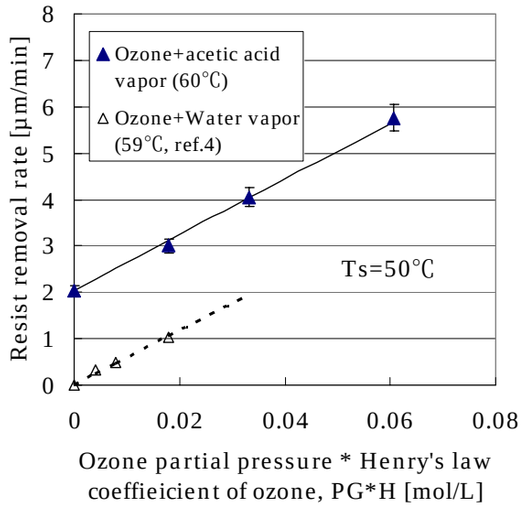

Fig.2 Influence of ozone gas concentration (partial pressure) on the removal rate. Substrate temperature Ts=50℃, Acetic acid 60℃, Water 59℃, gas flow rate 2L/min.

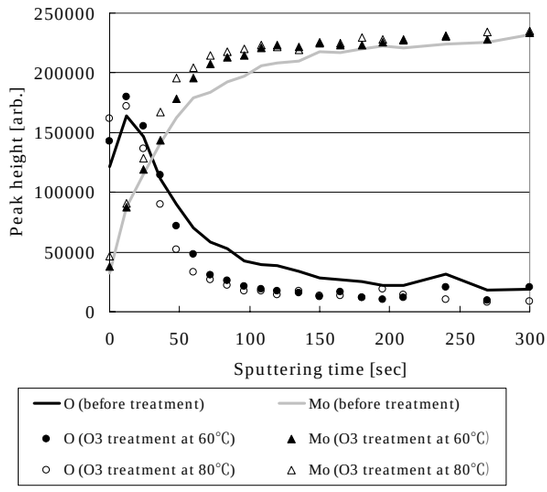

Fig.3 AES depth profile of the Mo electrode after the resist removal. Substrate temperature Ts=50℃, Acetic acid T_A=60℃ and 80℃, ozone treatment time 2min, gas flow rate 2L/min.

References

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