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Origin of Substrate Heating During Oxide Film Deposition by DC Magnetron Discharge and Superposition of VHF Power KENTA SETAKA, TAKASHI FUKUI, KENSUKE SASAI, Nagoya University, HIROTAKA TOYODA, Nagoya University, PLANT, Nagoya University — Magnetron plasmas are one of the important tools for thin film deposition such as metal, oxides and so on. In general, quality of sputter deposited film is influenced by substrate temperatures and this implies that the discharge condition is strongly related to the film quality. In this study, substrate temperature is measured in a DC magnetron plasma with VHF power superposition and origin of substrate heating is investigated. In the experiment, ITO films are deposited by a DC magnetron sputter source to which VHF power is superposed. Substrate temperature is measured as a function of VHF power fraction with respect to total discharge power, i.e., DC and VHF powers. The substrate temperature shows the minimum at VHF power fraction of $\sim 60\%$. From Langmuir probe measurement and laser absorption spectroscopy, both plasma density and gas temperature monotonically increases with the VHF fraction, which explains the substrate temperature increase at high VHF power fractions. However, the temperature increase at low VHF power fraction cannot be explained by heat flux by ions or discharge gas. Contribution of negative ion impingement to the substrate is considered to be the origin of the substrate temperature at low VHF power fractions or conventional DC sputter depositions.

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