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Effect of the Neutral Beam Energy on Low Temperature Silicon Oxide Thin Film Grown by Neutral Beam Assisted Chemical Vapor Deposition

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Low temperature SiOx film process has being required for both silicon and oxide (IGZO) based low temperature thin film transistor (TFT) for application of flexible display. In recent decades, from low density and high pressure such as capacitively coupled plasma (CCP) type plasma enhanced chemical vapor deposition (PECVD) to the high density plasma and low pressure such as inductively coupled plasma (ICP) and electron cyclotron resonance (ECR) have been used to researching to obtain high quality silicon oxide (SiOx) thin film at low temperature. However, these plasma deposition devices have limitation of controllability of process condition because process parameters of plasma deposition such as RF power, working pressure and gas ratio influence each other on plasma conditions which non-leanly influence depositing thin film. In compared to these plasma deposition devices, neutral beam assisted chemical vapor deposition (NBaCVD) has advantage of independence of control parameters. The energy of neutral beam (NB) can be controlled independently of other process conditions. In this manner, we obtained NB dependent high crystallized intrinsic and doped silicon thin film at low temperature in our another papers.

We examine the properties of the low temperature processed silicon oxide thin films which are fabricated by the NBaCVD. NBaCVD deposition system consists of the internal inductively coupled plasma (ICP) antenna and the reflector. Internal ICP antenna generates high density plasma and reflector generates NB by auger recombination of ions at the surface of metal reflector. During deposition of silicon oxide thin film by using the NBaCVD process with a tungsten reflector, the energetic Neutral Beam (NB) that controlled by the reflector bias believed to help surface reaction. Electrical and structural properties of the silicon oxide are changed by the reflector bias, effectively. We measured the breakdown field and structure property of the Si oxide thin film by analysis of I-V, C-V and FTIR measurement.

Keywords: Silicon oxide, Neutral beam, Low temperature deposition, Neutral beam assisted chemical vapor deposition