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Characterization of Low Stress Silicon Nitride for Stacked structure application

Kyoung Pil Na, So-Yeon Park, Young Soo Kwon, Do-Hyoung Lee

ATTO.CO.,LTD.

A fabrication method to produce low stress silicon nitride (SiNx) layers was developed for stack flash technology reported in paper [1]. The flash memory industry is strongly demanded to keep a trend of increasing bit density and reducing bit cost. Among the efforts to achieve that, stack flash technology has been proposed for a future ultra high density memory device in a trend of increasing bit density and reducing bit cost [2,3]. In the stack flash memory, the SiNx film plays a critical role, due to its nitride trap properties, gate leakage current and disturbance characteristics. For stack flash memory, the method of decreasing film stress applies high frequency (HF) power and low frequency (LF) power alternatively during the deposition process. Also, the other method is to add He to the standard gas mixture of SiH_4, N_2 and NH_3 to adjust the stress of SiNx layer. In addition, the our paper also investigated the influence of other important parameter, such as LF frequency & power and gases flow rates. Finally, we can be achieved by the modification of gases flow rate or LF power. The main parameters present a strong influence on the deposition uniformity, reflective index (RI), stress value and deposition rate. We can understand the mechanism about stress control of the SiNx film.

[1] J. Wei et al., Thin Solid Films, 516 pp 5181-5188,2008.

[2] H. Tanaka et al., Symp. on VLSI Tech. Dig., pp 14-15,2007.

[3] Y. Fukuzumi et al., IEDM Tech. Dig., pp 449-452, 2007.