Study of the Defects in Si-rich SiO_2 Films Prepared by RF Magnetron Co-sputtering Using Variable Energy Positron Annihilation Spectroscopy

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Si-rich SiO_2 films prepared by RF magnetron co-sputtering method have been studied by slow positron beam. The negatively charge point defects (probably P_b centers or peroxy radicals) at the silicon nanocluster (nc-Si) / SiO_2 interface are observed by Doppler broadening spectra. Coincidence Doppler-broadening spectra show positrons have a higher annihilation probability with core electrons nearby oxygen atoms than silicon atoms. The formation of N-related bonds may be the reason for the prevention of the migration reaction of Si and O atoms, hence nc-Si formation is inhibited by annealing in nitrogen compared to in vacuum.