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Possibility of Simultaneous Monitoring of Temperature and Surface Layer Thickness of Si Substrate by In Situ Spectroscopic Ellipsometry

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The possibility of simultaneous monitoring of the temperature and the thickness of the surface layer of a crystalline silicon (c-Si) substrate by *in situ* spectroscopic ellipsometry (SE) is demonstrated using a surface adsorption layer (SAL) as an example. The model dielectric function (MDF) developed by Adachi and the tabular data of the dielectric function of fused silica were applied to a Si wafer and SAL, respectively. The best-fit curve has been obtained by fitting the measured Ψ and Δ spectra simultaneously by adjusting the 12 MDF parameters and the thickness of SAL over the temperature range of 293–803 K. The best-fit MDF parameters indicate that the SAL thickness has almost no influence on the best-fit values of the MDF parameters. This fact can be used to monitor the temperature of a c-Si wafer independent of the thickness of surface layer by checking the shift of MDF parameters (e.g., E_2) using the SE and the MDF. The measurement errors in thickness and temperature are roughly estimated to be 0.1 nm and less than 10 K, respectively.

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