AN 425
Oxide Thickness Measurements by Electron Spectroscopy for Chemical Analysis

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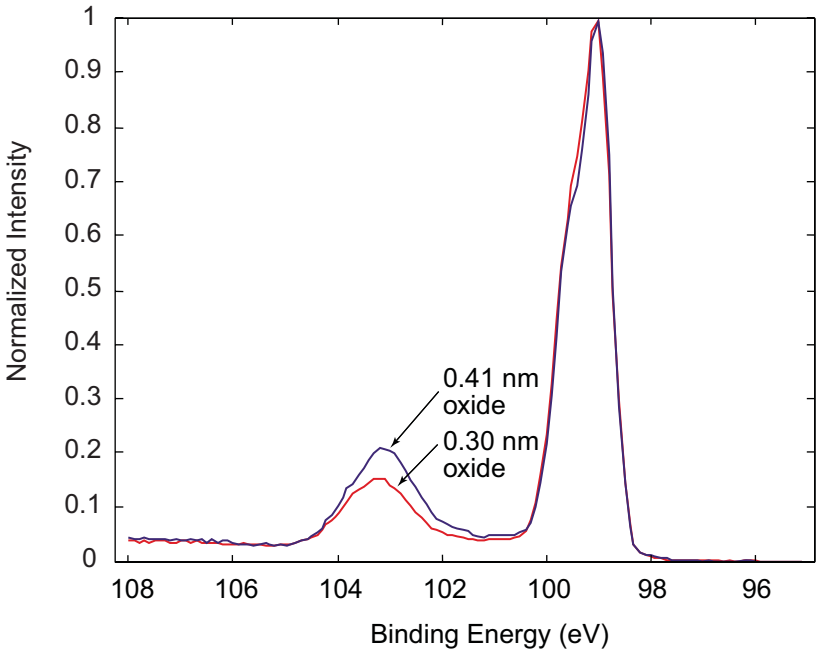
Discussion

Measuring the thickness of oxides on wafers can be accomplished by a variety of techniques, including TEM, ellipsometry and ESCA (also known as XPS). While TEM requires extensive sample preparation and ellipsometry cannot accurately measure extremely thin oxides (<0.8 nm), ESCA can be used to measure oxides with an average thickness of <0.1 nm with minimal sample preparation. Additionally, ESCA is unaffected by surface contamination, which can influence ellipsometry results.

The figure below shows ESCA data from two silicon wafers. The peak at 99 eV is from elemental silicon (the substrate), and the peak at 103 eV is from SiO_2 (the oxide). The calculated thicknesses of these two oxides are 0.41 and 0.30 nm. This data shows two important points: ESCA can detect and measure very thin oxides, and it can distinguish small differences in oxide thickness.



The Si2p region on two wafers. The peak at 99 eV is from the silicon substrate, the peak at 103 eV is from the oxide.

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