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How thick is my film?¹

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Modern semiconductor devices for phones or laptops contain 40 or more different layers (insulators, semiconductors, metals). The device response (current versus voltage) and reliability depend critically on the individual layer thicknesses. This makes the art of measuring thicknesses very important. As physicists, we easily understand that thicknesses can be measured very quickly using optical or x-ray interference techniques, if the wavelength of the light is on the order of the film thickness. I will show examples of such thickness measurements from the latest semiconductor technology process flows. I will also describe other physics-based thickness measurement techniques, such as characteristic x-ray emission or x-ray diffraction. The most powerful measurement technique found in every semiconductor factory is spectroscopic ellipsometry, which detects the change in the polarization of light when it is reflected by a layered semiconductor structure.

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