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Validiation of Photometric Ellipsometry for Refractive Index and Thickness Measurements

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Abstract
We design and build a photometric ellipsometer that can be adjusted or modified to match specific needs for different experiments. To validate our setup, we test the system with glass substrates at multiple incident angles from 30 to 70. The experimental data can then be fitted to the standard theoretical model for ellipsometry with a single interface, allowing the amplitude ratio (tan Ψ) and the phase difference (Δ) to be evaluated as fitting parameters. As a result, we obtain the refractive indices of glass as 1.44–1.55 depending on the backing material. By the same means, it is also feasible to derive thicknesses of silicon oxide films. The resulting thicknesses are in good agreement with those determined by a commercial ellipsometer with the minimum deviation of 0.2 %.

Keywords
Ellipsometry – Photometer – Refractive index