For many electronic and other purposes, oxides in the range 2 nm to 10 nm are grown on silicon. These layers are usually monitored and measured by ellipsometry. Ellipsometry is particularly favoured as it may be integrated into semiconductor production lines, it is fast and, using optical radiation, is relatively benign. Modern ellipsometers can be used to map large wafers in detail with precisions of 0.002 nm (i.e. 0.05%). Unfortunately, it is not known if calibrations of ellipsometers, made for thicker films, can be extended down into this region. Also, unfortunately, the method does not distinguish variations in the oxide thickness from variations in the carbonaceous or water contamination overlayers that will always be present in samples exposed to the environment. Ellipsometric analysis of a 200 mm wafer with 4 nm of oxide shows a ring of increased thickness that may be of oxide or contamination that is 0.2 nm thicker than the central region of the wafer, as shown in Fig 1(a). By mapping with ARXPS, using a new Thermo VG Scientific Theta 300 instrument, the true aspects of this oxide profile may be verified, as shown in the plot for the lower half of the wafer in Fig 1(b). Improvements in the data processing of the Theta 300 probe measurements allow similar maps to those of ellipsometry to be obtained with a thickness precision of 0.01 nm (i.e. 0.2%).

![Fig 1 Maps of a wafer with 4 nm oxide and contours at 1% intervals by (a) ellipsometry and (b) XPS.](image-url)