



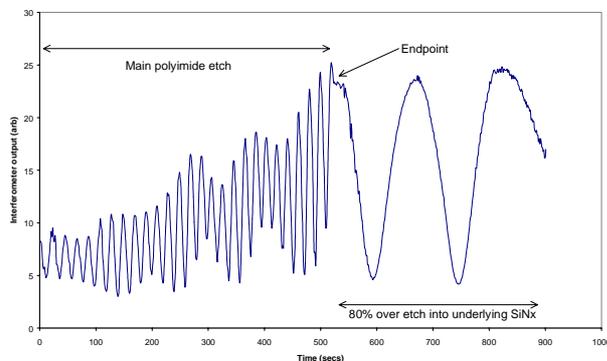
© Oxford Instruments plc
October 2001
email: plasma@oxford.de

Plasmalab Data

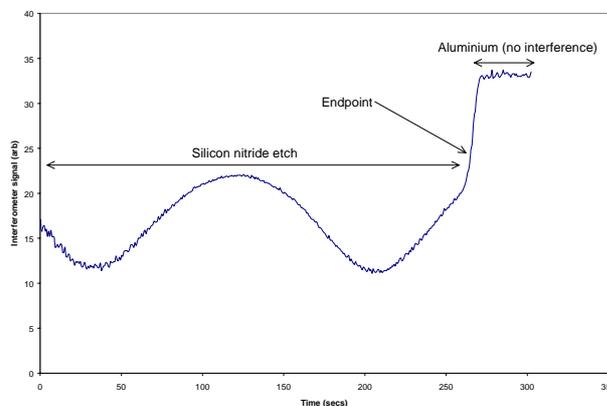
Laser Interferometry for Precise Layer Removal in Failure Analysis

- Precise Endpointing
- Real-time display
- Fully automatic

Laser interferometry is a highly versatile endpointing and diagnostic technique commonly used in dry etch applications. At Oxford Plasma Technology, we have fully integrated a solid state laser interferometer with positioning camera onto our dedicated failure analysis tool, the *Plasmalab 80 Plus*. The advantages of using the laser interferometer over conventional timed etching are numerous. The interferometer trace is displayed in real-time during the etch on the system PC, whereby real-time etch rate information can be obtained. The software also allows automatic endpointing within pre-determined criteria or manual endpointing by the user at any time for processing layers of unknown thicknesses.



Laser Interferometer trace from a polyimide over silicon nitride etch.



Laser Interferometer trace from a silicon nitride over aluminium etch.

The figure opposite shows the resulting trace from a polyimide over silicon nitride passivation etch. The period of the trace can be used to calculate the process etch rate as 1 period is equal to $\lambda/2n$ for that particular material, (λ is the wavelength of the laser, n is the refractive index of the material). Therefore, knowing the time taken to complete 1 period and the theoretical thickness calculated from $\lambda/2n$ allows calculation of the real-time etch rate.

The change in period at about 500 seconds indicates complete removal of the polyimide. The period then increases due to the much lower etch rate of the silicon nitride in this chemistry. The selectivity of this process was estimated at $>10:1$.

The second figure shows the trace from a silicon nitride over aluminium etch. Once the silicon nitride has cleared (270 seconds), no more light interference takes place resulting in a distinct flat trace.

Both conditions demonstrated provide precise and accurate determination of endpoint, allowing excellent process control for layer removal during failure analysis reverse engineering.