Introduction
Reactive Sputtering is used to produce functional coatings having properties that are suitable for a range of applications such as decorative, wear resistant, optical and magnetic thin films.

In Reactive Sputtering a target material (e.g. titanium or aluminium) is sputtered in the presence of a reactive gas (e.g. oxygen or nitrogen) to produce a compound such as TiN or Al₂O₃.

Both the coating rate and film stoichiometry are sensitive functions of the reactive gas partial pressure and control of this pressure is key to producing good quality coatings with reasonable deposition rates.

At low partial pressures film compositions (and therefore properties) are not ideal. At higher partial pressures the target may be poisoned by reaction with the reactive gas. The ideal operating point is between these two extremes and past attempts have focused on controlling the flow of the reactive gas in order to maintain the partial pressure within this region. This has proved unsuitable however due to inherent instabilities and in practice forbids a range of very useful film compositions between the high and low reactive gas partial pressures (Fig.).

HPR-30 Process Gas Analyser
Hiden Analytical’s HPR-30 Process Gas Analyser is used to monitor the reactive gas partial pressures, providing the corresponding real time signal outputs for use in commercially available reactive sputtering control systems (e.g. Advanced Energy ‘IRESS’ controller).

The compact RGA/head manifold bolts directly to the coating chamber and samples process gases through a unique re-entrant aperture (Fig. 3).

Vacuum & Process Diagnostics
In addition to process measurements the HPR-30 is equipped with auto-switching inlet for accurate base pressure fingerprinting and vacuum diagnostics such as leak checking and contamination source identification (Figs. 4a and 4b).

Multi-Gas Reactive Sputtering
Two-gas reactive sputtering is sometimes used for decorative/functional coatings and has possible use for e.g. new high-k dielectric materials.

With flow control there are trapping zones where one of the reactive gases can trap the target in a poisoned mode (Fig. 5a) and which can only be recovered from by removing both of the reactive gases. Control of both reactive gases avoids this (Fig. 5b).

Conclusions
Partial pressure control allows stable operation in processing regions unavailable with simple flow control.

The deposition rate for the nitride increased from 0.4 to 3.5 microns/inch/minute by the use of partial pressure control.