

## New Possibilities in High Sensitivity Low Energy Ion Scattering (LEIS) for Probing the Outermost Atomic Layer

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### Introduction

The Qtac<sup>100</sup>, a new high sensitivity and high resolution Low Energy Ion Scattering (LEIS) instrument, makes a wide range of new applications available for this extremely surface sensitive analytical technique. Well-known capabilities of LEIS are the characterisation and quantification of the atomic composition of the outermost atomic layer, precisely those atoms that largely control catalytic performance [1]. New possibilities such as surface imaging and sputter as well as non-destructive (static) profiling have been added.

The higher energy range of the primary ion source of up to 8 keV allows an improved mass resolution, thus enabling a better separation of the heaviest elements. In addition, a time-of-flight filter dramatically improves the detection limit for light elements. This filter suppresses the signal arising from sputtered ions, but allows the scattered ions to reach the detection system.

### Results and Discussion

In this contribution, we show the application of these new capabilities of the Qtac<sup>100</sup> to a range of samples and demonstrate

- analysis of highly dispersed catalysts with low loadings of the active phase
- analysis of the outer surface of nanoclusters
- information on the site of poisons, promoters
- possibility of high throughput analyses of large arrays of samples

We will especially concentrate on the new possibility of resolving and quantifying elements with very small difference in mass or even with overlapping isotopic distributions. Examples which are relevant for the field of catalysis are Au/Pt and Ag/Pd. The results show that the quantification is feasible even with coverages in the sub per cent range of one monolayer, utilising the high primary ion energy and TOF filtering of the Qtac 100.

### Significance

The work presented here shows the ability of high resolution Low Energy Ion Scattering to characterise the elemental composition of both model and industrial ('real world') catalysts. The presentation gives an overview about the applications in catalytic research, focusing on newly developed features and their practical benefit to the analyst.

### References

1. Brongersma, H. H. et al. *Surf. Science Reports* 62 (2007) 63 – 109