

# TOTAL SOLUTIONS FOR THE CERAMICS INDUSTRY

# CSMA



The field of ceramics utilises an ever-increasing array of compositions in addition to a large number of processing techniques employed in material production through to product finishing. Surface analysis plays a key role in the characterisation of these materials. The high sensitivity of techniques such as X-ray Photoelectron Spectroscopy (XPS) and Secondary Ion Mass Spectrometry (SIMS) can be invaluable in establishing the material chemistry, particularly for low level additives and impurities.

## BENEFITS TO CUSTOMER

- Location of ppm/ppb levels of elements in the microstructure
- Characterisation of ceramic compositional change with depth
- Analysis of nm thick surface layers (no other technique available)
- Reverse engineering and analysis of competitor products



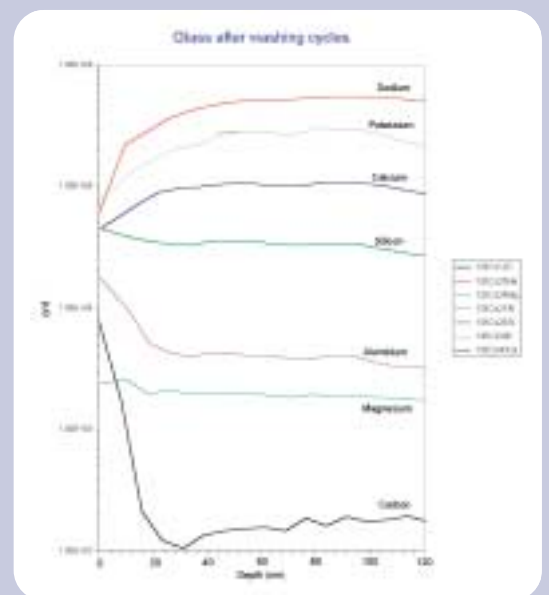
## GLAZE CHARACTERISATION

The visual degradation of glassware and ceramics, as a result of long term exposure to automatic dishwashing products, has prompted considerable research effort to find new formulations which slow down or prevent these effects. Degradation can range from a slight haze to complete removal of a decorative layer.

SIMS depth profiles were conducted from the glaze surface into the main body. These indicate **critical changes in composition of the glazes over a depth range of a few tens of nanometres.**

For the unwashed ceramics, sodium and potassium levels are highest at the outermost surface after which the levels decrease gradually over approximately 50 nm from the surface. For a washed ceramic, the surface concentration of these elements decreases at a rate which is related to the number of wash cycles the ceramic has endured. Monitoring of these compositional changes as a function of wash conditions and detergent formulation has provided development scientists with a detailed insight into the corrosion mechanism and enabled tailor-made changes to detergent formulations.

Similarly, the technique provides a method for measuring the effects of kiln conditions during manufacture of the ceramic and development of longer-lasting ceramics.





## Authenticity of an Antique Ceramic



The “Black-Haired Clown” jug

CSMA recently helped to provide one of the final pieces of evidence to support the authenticity of a unique Royal Doulton character jug. The jug, known as the ‘Black-Haired Clown’, was manufactured in Stoke -on -Trent in the war years 1937 - 1942 but since its discovery in 1986 doubts had existed amongst Royal Doulton experts regarding its authenticity. It is known that Royal Doulton produced three different coloured hair clown character jugs in white, brown and red but never in black. A technical investigation by the Doulton Quality Control Department reported that the black hair had been painted and fired onto the jug but could not state that it had been done at Royal Doulton’s factory.

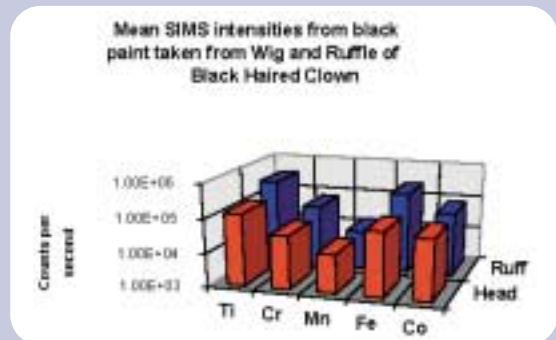
CSMA were given the task of determining the composition of the paint pigments.

The method used was to scientifically test the black hair paint and compare it with the black paint line on the clown’s ruff, a standard feature of all Royal Doulton clown character jugs.

Minute quantities of the black paint from the hair and ruff were carefully obtained. A grinding wheel and a large area of white paper were used to catch the tiny fragments which were then harvested using soft indium metal. Optical microscopy was used to ascertain the presence of sufficient pigment on the indium before analysis by Secondary Ion Mass Spectrometry.

After careful analysis of many pigment particles, followed by statistical appraisal, the result was clear - the black paint used on the hair and ruff were of the same composition.

**The scientific evidence provided by CSMA has led to certificated authentication of the “Black-Haired Clown”.**



**Graphical representation of the SIMS data showing comparable compositions of pigment particles taken from hair and ruff.**

CSMA provides a complete surface analysis service to industry to accommodate every level of demand:

- rapid turnaround analysis (24 hours)
- problem solving and failure analysis
- litigation and expert witnesses
- training courses
- reverse engineering and competitor analysis
- materials and product development
- patent registration / infringement

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