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APPLICATION NOTE

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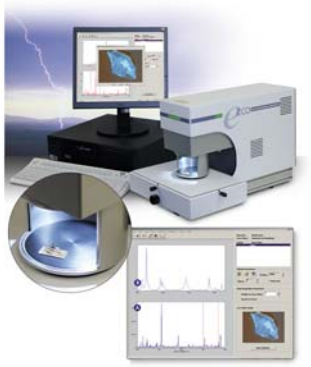
4: IDENTIFYING SECURITY DOCUMENTS USING ECCO



ECCO
Elemental Composition Comparator

Paper

VSC6000
Video Spectral Comparator

Introduction

The most commonly applied method for the forensic examination of paper involves close visual inspection, possibly aided by the wide spectral range of the UV, IR and visible light sources in instruments such as the Foster + Freeman Video Spectral Comparator.

Recent studies have been reported, however, in which paper has been examined using elemental analysis techniques [1, 2, 3]. These studies have tended to make use of the trace elements, e.g. barium (Ba) and strontium (Sr), which occur as impurities in the calcium carbonate ($CaCO_3$) used as an optical brightener.

Security papers, however, tend to have a quite different composition to normal types of paper and are often devoid of optical brighteners. Instead, uncommon elements, such as manganese (Mn) or titanium (Ti), may be present, either having been added intentionally during manufacture or occurring incidentally as a constituent of organic dyes.

In this Application Note, three different types of security paper are examined using the ECCO. Each shows different elemental profiles.

The ECCO relies on the technique of Laser Induced Breakdown Spectroscopy (LIBS) and involves the generation of optical emission spectra from the target material that are characteristic of its elemental composition.

Paper Samples

The study reported here involved subjecting small sections of the inner pages of three different passports to analysis using the ECCO.

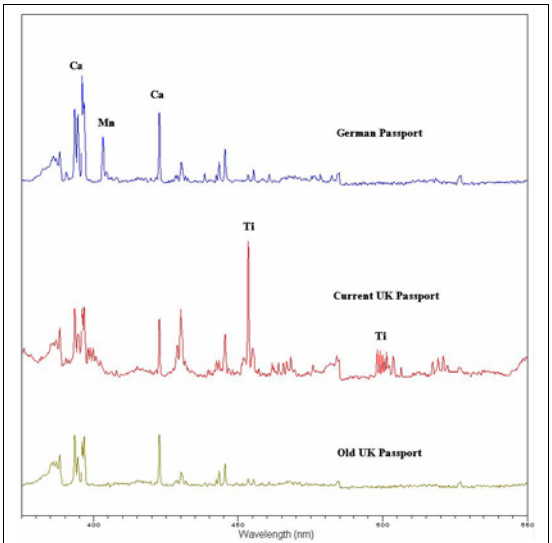
Results

ECCO provides the user with a spectral “fingerprint” of the elemental composition of the target material, in this case paper. The heights of the characteristic peaks in the ECCO spectrum are a measure of the concentration of the corresponding elements contained in the material.

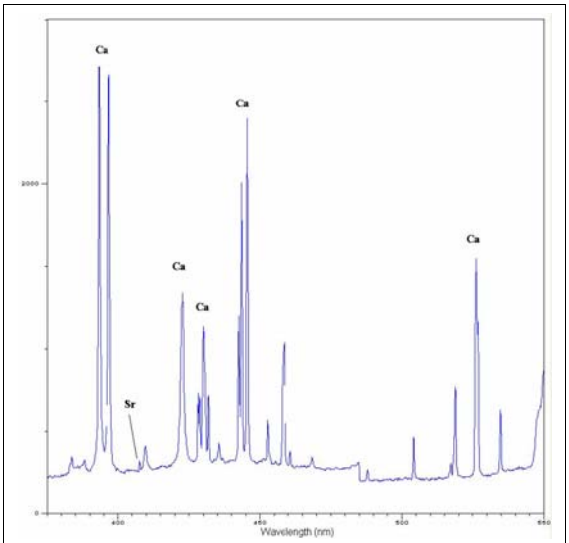
The spectra overleaf all show clear differences. In particular, the presence of manganese (Mn) or titanium (Ti) successfully discriminates between the three types of passport.

Passport	Element	
	Manganese	Titanium
German	✓	×
UK	×	✓
UK (old style)	×	×

Note that the ECCO spectrum of typical A4 office photocopy paper is dominated by peaks associated with the calcium (Ca) in the optical brightener although a small peak due to strontium (Sr) is also visible.



ECCO spectra from passports



ECCO spectrum of typical A4 office photocopy paper

Conclusions

The ECCO provides a fast and effective method for detecting trace elements in paper. The ECCO has been used to discriminate between the different types papers used in certain passports.

It is likely that the ECCO can also discriminate between other types of security paper, such as that used in banknotes, driving licences and vehicle registration documents.

Unlike other elemental analysis techniques, the ECCO requires very little sample preparation. The instrumentation is cost effective, compact and almost free of maintenance.

References

[1] L.D. Spence, R. Francis and U. Tinggi, J Forensic Sci. 2002, 47, pages 648 – 651.

[2] L.D. Spence, A.T. Baker and J.P. Byrne, J Anal At Spectrom 2000, 15, pages 813 – 820.

[3] A.E. Polk and A.E. Allard, J Forensic Sci., 1977, 22, pages 524 – 533.

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