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Application Note

Forensics

Raman

RA20

The non destructive and in-situ identification of different black inks

It has been a problems for a long time for forensic scientists, customs officials and historians alike to be able to verify and authenticate printed documents just from the inks that have been used.

It is a difficult and often impossible task to analyse an ink in-situ on a paper surface and techniques such as GC-MS and HPLC are fundamentally destructive requiring complicated extraction procedures to isolate the ink constituents before analysis.

The technique of Raman Microscopy offers a non destructive mode of ink analysis which can directly identify and characterise specific inks found on the paper surface.

The following is a brief study of black inks commonly used in different desktop printers, and the identification of the source of a particular document.

Ink Analysis

Three reference samples of black ink from a Laserjet printer, Inkjet printer and photocopier were analysed on the LabRAM analytical Raman microscope. The system was equipped with the internal HeNe laser excitation. The high efficiency of the system enabled samples to be analysed in only 1-2 minutes and with very low laser powers, typically less than 1mW.
Using the high level of confocality of the LabRAM system, the ink used in a particular document was analysed in-situ on the paper.

The origin of the article was unequivocally established by comparing the Raman spectral fingerprint of the ink sample with those of the ink references.

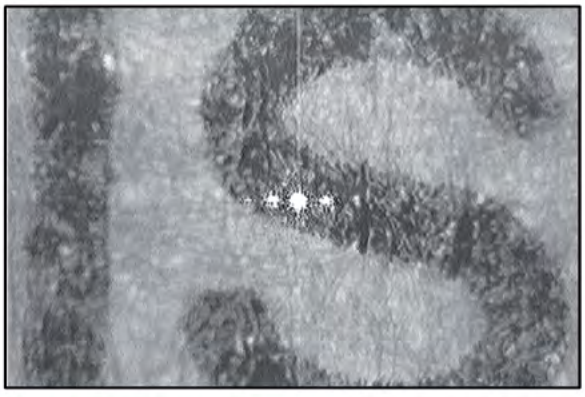

Figure 1. Video image of magnified print of the document. The white spot in the centre shows the position of the laser spot on the sample. Image size ~700x1000mm

Our results report the following

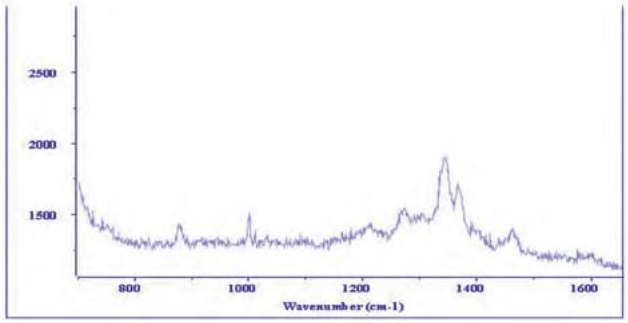

Figure 2. Raman spectrum of pure ink for a Laserjet printer.

Ink from an Inkjet printer produces a different and equally characteristic Raman fingerprint.

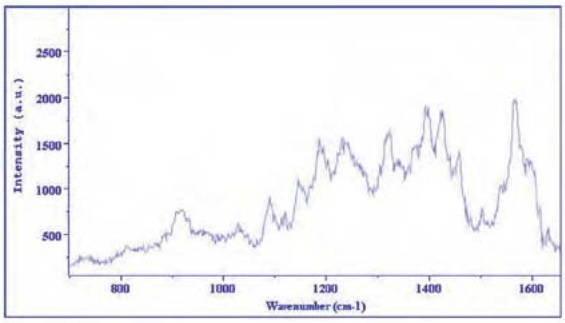

Figure 3. Raman spectrum of pure ink for an Inkjet printer.

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Ink from a photocopier produced a third and still more different Raman fingerprint

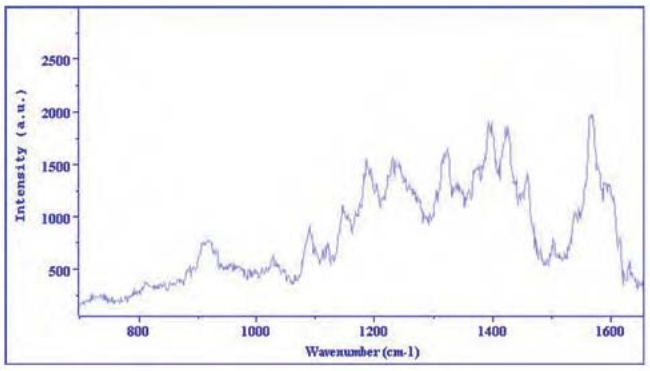

Figure 4. Raman spectrum of pure ink for a Photocopier printer.

We can see that by close comparison of the Raman spectra of these reference black inks, it is possible to distinguish characteristic spectral features and combinations which are exclusive to each individual ink.

Hence, it should be possible to identify which ink and indeed in this case which type of printer was used to produce the document of interest.

It can be seen from these results that there is no evidence to show that either a photocopier or Inkjet printer was used in this document.

However, there is a close correlation between the Raman fingerprint of the pure ink reference for the Laserjet printer and that obtained for the ink used in the printing of the document (see figure 5.)

Conclusion

It is possible for us to determine the origin of this document as being the Laserjet printer.

Analysis of the Document

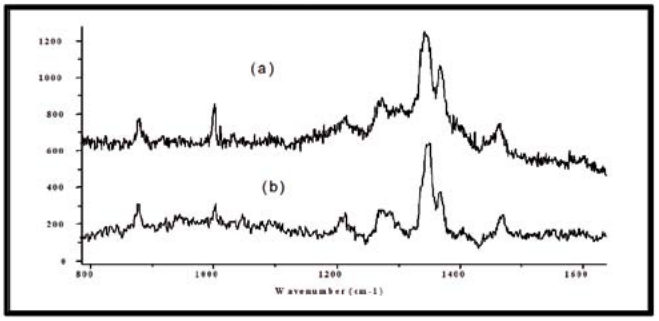

Figure 5. Raman spectrum of (a) pure ink for a Laserjet printer and (b) ink from the document print itself

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info.sci@horiba.com
www.horiba.com/scientific

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USA: +1 732 494 8660 **France:** +33 (0)1 64 54 13 00 **Germany:** +49 (0)89 4623 17-0
UK: +44 (0)20 8204 8142 **Italy:** +39 0 2 5760 3050 **Japan:** +81 (0)3 38618231
Spain: +34 91 490 23 34 **China:** +86 (0)10 8567 9966 **Brazil :** +55 11 5545 1540
Other Countries: +33 (0)1 64 54 13 00