

To expose forgeries, the Document Laboratory of the Zurich Cantonal Police successfully applies thermal desorption coupled with GC/MS.



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A new method helps to clearly establish the facts and determine whether handwritten or printed text is authentic or not. If not, it can be determined at what point in time the text was altered.

Hot in pursuit of forgers

Forensic science has contributed greatly to the exposure of forgeries: „Today we are in a position to determine if handwritten or printed lines are original or if they have been manipulated, if documents have been altered or if they have been forged entirely”, says Dr. Andreas Rippert of the Department of Forensic Sciences of the Zurich Cantonal Police. The forensic chemist adds: „We can now also pinpoint

the time when a document was forged, which could help us solve open cases.”

Pyrolysis GC/MS complicates the picture

Pyrolysis GC/MS is often used to examine paper and documents. The sample is pyrolyzed under anaerobic conditions, i.e. under a flow of oxygen-free inert gas. While Pyrolysis GC/MS provides a lot of informa-

tion, the technique does pose a problem, according to Dr. Rippert: „Attempts to reveal the document’s material composition using pyrolysis GC/MS result in a large number of peaks, which could originate either from the ink or from the paper. In addition, the high temperatures used give rise to decomposition products that further complicate data interpretation.”

Thermal Desorption – the method of choice

„To reach a clear conclusion about the authenticity of a document, a GC introduction method is needed that provides the possibility of varying, i.e. programming the temperature over the course of the thermal desorption / thermal extraction step. Organic compounds are extracted from the sample in successive steps at different temperatures”, says Dr. Rolf Hofer of the Department of Forensic Sciences of the Zurich Cantonal Police. Dr. Hofer and his forensic expert colleagues used the GERSTEL Thermal Desorption System (TDS) to develop



The document laboratory of the Zurich Cantonal Police uses a GERSTEL Thermal Desorption System (TDS) in combination with a GERSTEL Cooled Injection System (CIS) and an Agilent Technologies GC 6890/5973 MSD. The system is used to differentiate between ink samples.

“While the complete range of detected substances is required for conclusive classification and differentiation of written material, phenoxyethanol and phenoxyethoxyethanol are the main indicators when it comes to age determination.” Rolf Hofer, Ph.D.

this analysis method. “As carrier gas sweeps across the paper sample at increasing temperatures, the relevant analytes ranging from volatile to semi-volatile, are successively desorbed and cryofocused prior to introduction to the GC/MS system.”

Analysis and results

Dr. Andreas Rippert: „At temperatures below 100 °C, volatiles are extracted, especially phenol and benzene derivatives, as well as hydrocarbons up to heptadecane.”

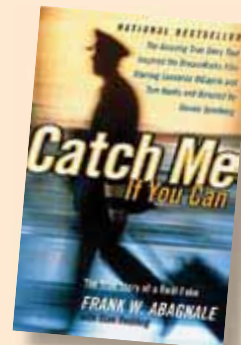
At temperatures above 100 °C less volatile compounds such as fatty acids, phthalates, and higher-boiling hydrocarbons are extracted. The scientist explains: “If ink has been applied to the document during the past weeks, i.e. in case of „fresh tracks“, hydrocarbons are emitted in clearly detectable quantities, as are semi-volatile compounds like phenoxyethanol and phenoxyethoxyethanol. At 210 °C, final residues of vola-

tile substances are desorbed even from older ink samples.” Dr. Rolf Hofer adds: “While the complete range of detected substances is required for conclusive classification and differentiation of written material, phenoxyethanol and phenoxyethoxyethanol are the main indicators when it comes to age determination.”

World-infamous document forgers

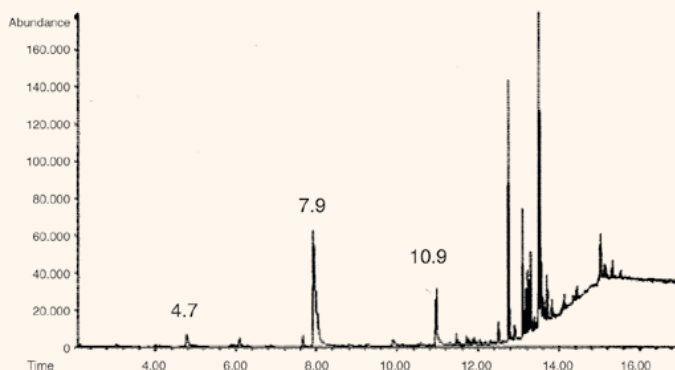
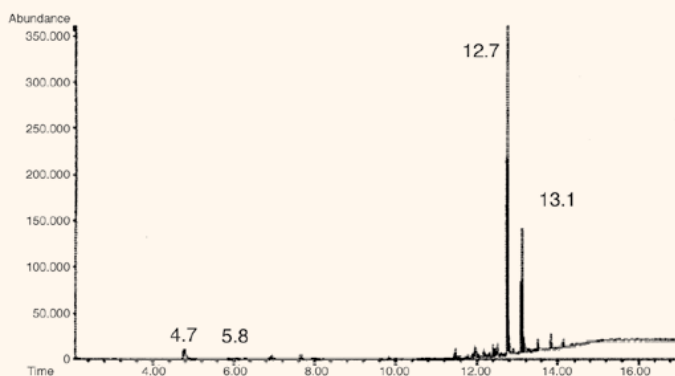
Frank William Abagnale, Jr. became known as a con-man and check-forgery in the late 1960's and early 1970's.

After being arrested in 1969 in France, he was sentenced and sent to prison there. Subsequently Abagnale was handed over to the authorities in Sweden, where he served a further prison sentence. Eventually, he was extradited to the U.S., and handed a further 12 year prison sentence. In 1974, Abagnale was offered an early release in return for putting his criminal expertise at the disposal of the U.S. Government. By applying his knowledge and experience to legal activities under the auspices of the FBI, Abagnale has become one of the leading experts on document fraud, specializing in check fraud.



Catch Me If You Can: The true story of a real fake (Paperback) by Stan Redding and Frank W. Abagnale.

He has worked as a consultant for various banks, airlines, hotels and other companies. Frank W. Abagnale's story was documented by Steven Spielberg in the movie: “Catch me if you can”, for which Mr. Abagnale helped write the script. ■



During thermal desorption, the carrier gas sweeps across the paper sample at successively increased temperatures. During this process, all relevant volatile and semi-volatile compounds are desorbed and determined.

210 °C

30:00 min

Residues:

VOC residues from older text samples.

100 °C

30:00 min

SVOC:

Long-chain fatty acids, phthalates, high-boiling hydrocarbons. Phenoxyethanol and phenoxyethoxyethanol from recently applied inks.

40 °C

30:00 min

VOCs:

Phenol- and benzene derivatives and hydrocarbons up to heptadecane.

Using a TDS/CIS-GC/MS system, the document laboratory of the Zurich Cantonal Police is able to identify ink from ballpoint pens from different manufacturers. It can also be determined when a particular text has been written. Cut-outs of less than 5 mm diameter from the document are sufficient for analysis and conclusive findings.