The non destructive and in-situ analysis of pigments

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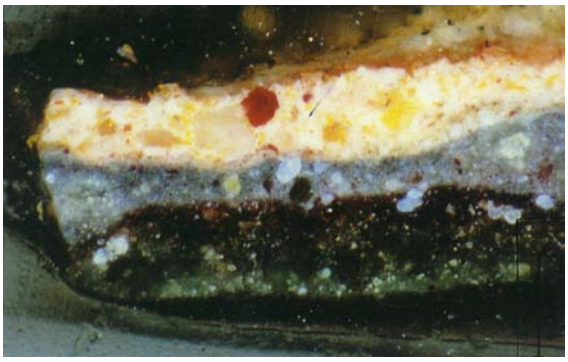
Introduction

In our daily life pigments are important for colouring of household utensils, e.g. varnishes, plastics, textiles, writings or art paints. The natural scientific identification of pigments has some problems, because of their insolubility in common solvents. Especially when one deals with examinations of very small sample amounts or wishes to perform non-destructive analysis, e.g. in forensic laboratories or analysis of art paintings. Raman spectroscopy turns out to be a ideally suited technique to solve these analytical problems. Questions of product identification, date analysis or detection of falsifications can now be solved using Raman spectroscopy. This analytical method is a powerful instrument for all these questions.



Cut through a painting showing different layers and separated pigments

Special fields in pigment analysis

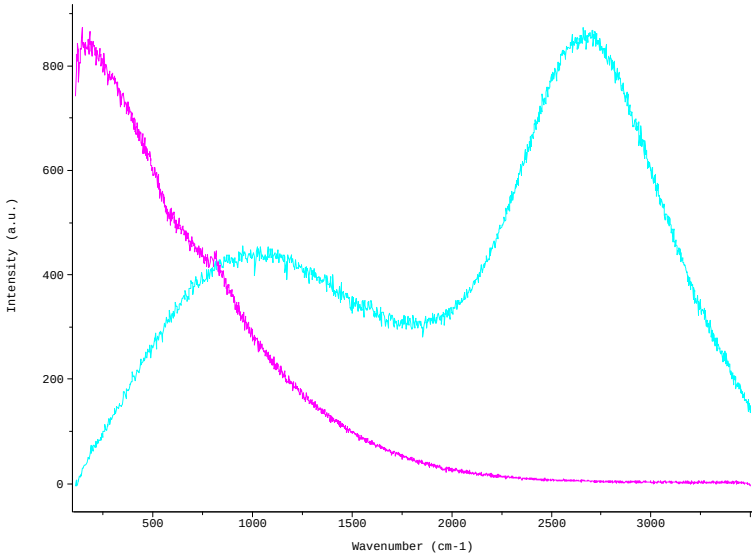
A major important forensic question is the study of varnish fragments of cars after hit-and-run offences.

This kind of analysis is done by comparison of the varnish that is found at the accident place and defined varnishes of car manufactories.

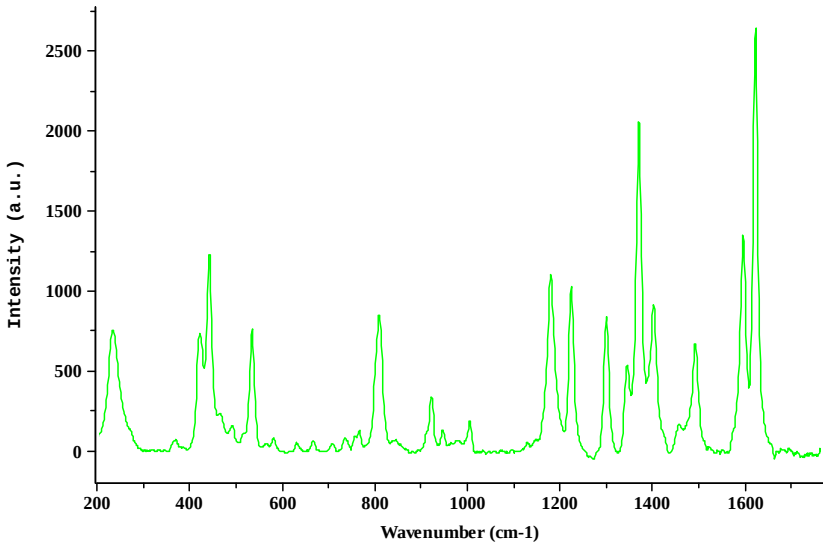
Another area is the association of plastics or textiles to commercial products. Analysing the pigments is often helpful in addition to material identification.
In the field of art analysis pigments often give information about the age, production processes, restorations or falsifications of arts. Combined with historical information this supports the valuation of arts.

Use of Raman Spectroscopy

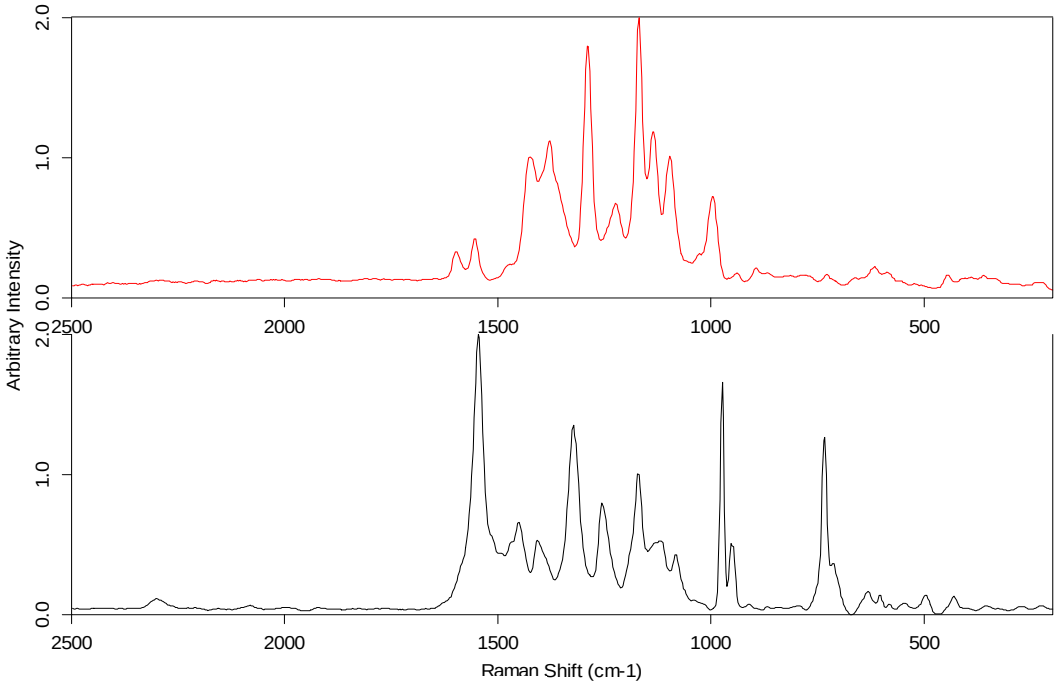
Modern dispersive Raman spectrometers coupled to a microscope give in combination with different laser excitations various possibilities for identification of organic and inorganic pigments. To get good spectra from red, yellow and white pigments, 633 nm and 785 nm laser wavelengths are the best choice whereas for green and blue pigments, a green excitation (514,5 nm or 532 nm) is often recommended (see picture below). To avoid fluorescence, it is basically necessary to have more than one laser.
The use of a microscope allows to get information with a high spatial resolution. This is realised thanks to the true confocal entrance optics of the **LabRAM** and **LabRAM *Infinity***, the latest being a fully automated Raman system.



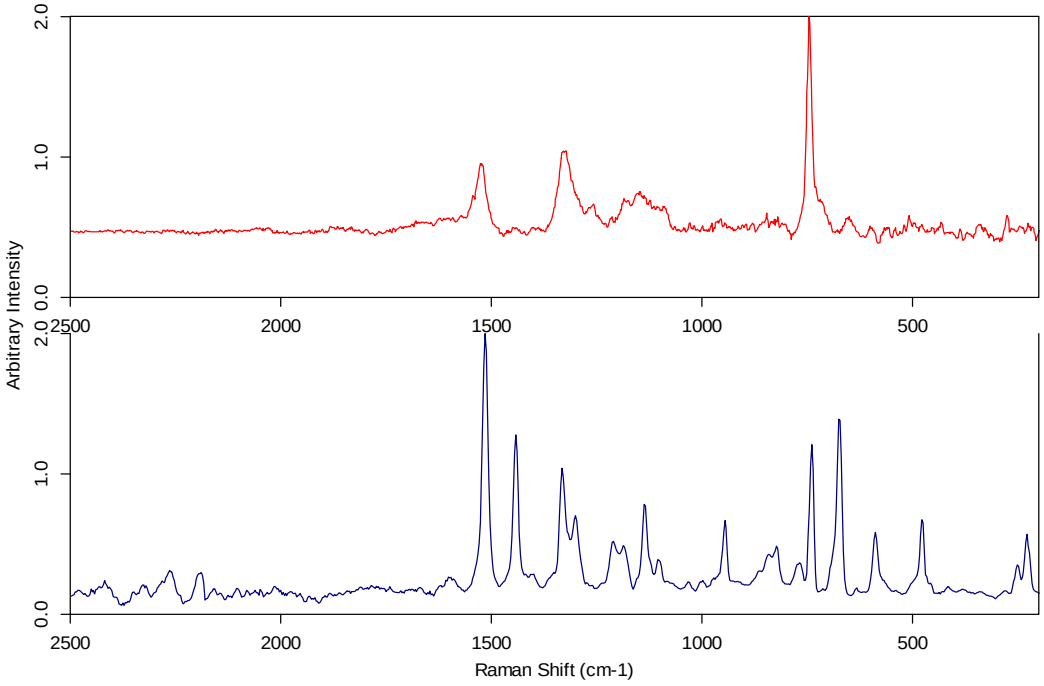
Malachite-green: 633 nm
785 nm
514 nm



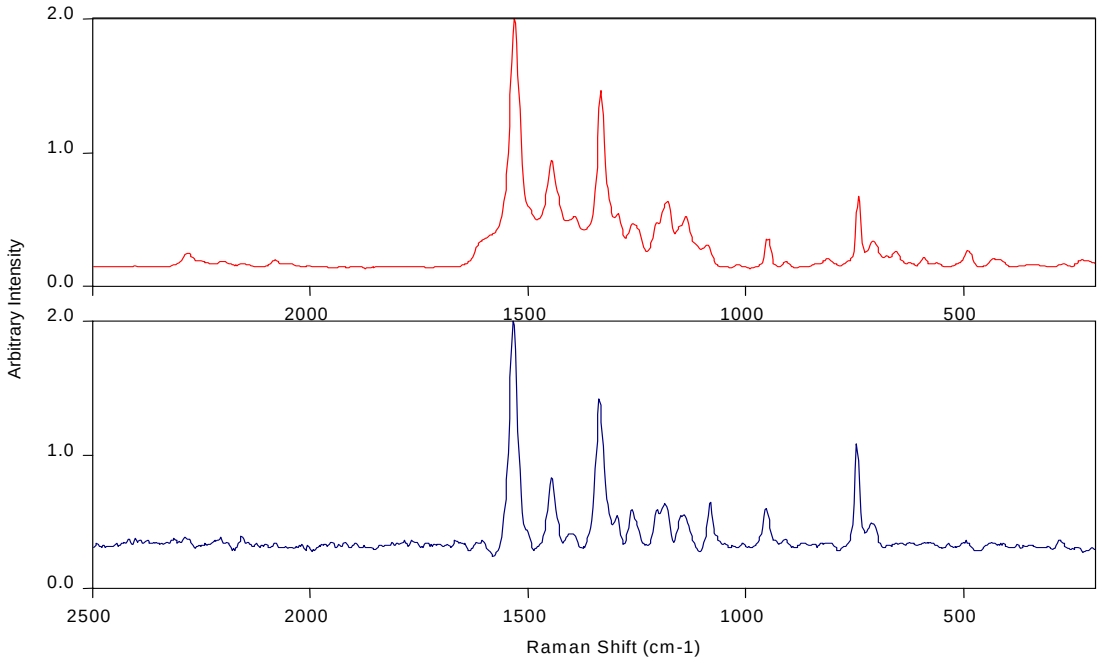
In the following section are examples of typical pigments showing great differences in the spectra.



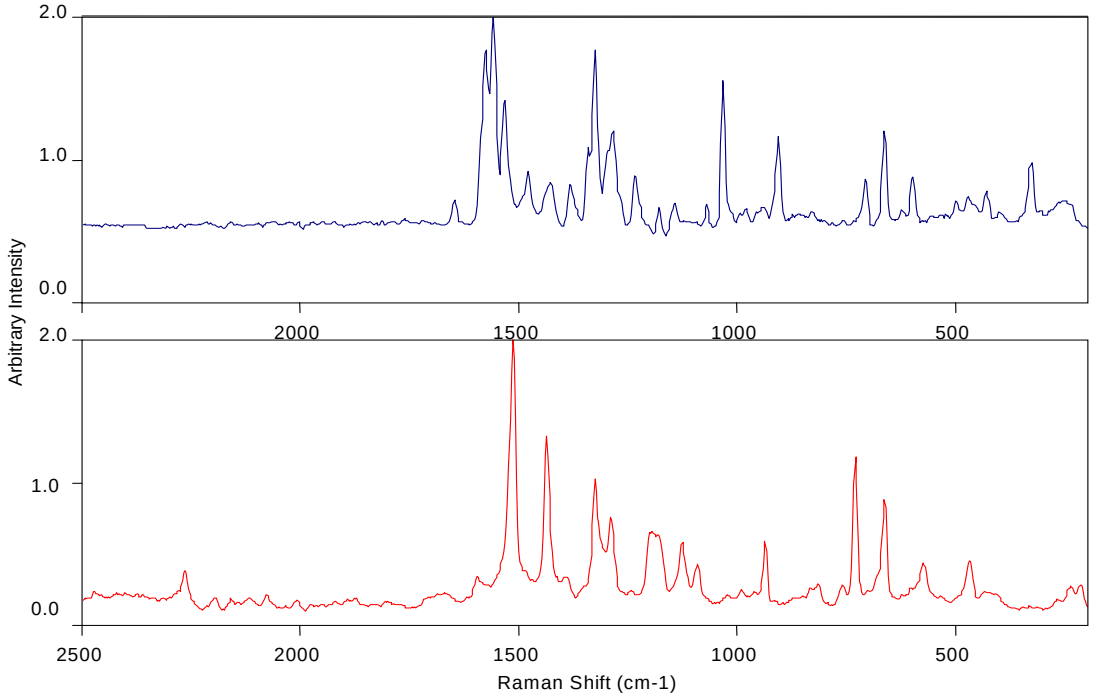
Textiles : _____ brown E-RN Levafix
_____ brilliant green GB Remazol



Pigments : _____ Procion Printing
_____ Cu-Phtalocyanine (blue)



Roller pen paste : blue paste, Papermate
blue paste, DDR-product



Car varnishes : Nissan ultrared
Lada skyblue

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