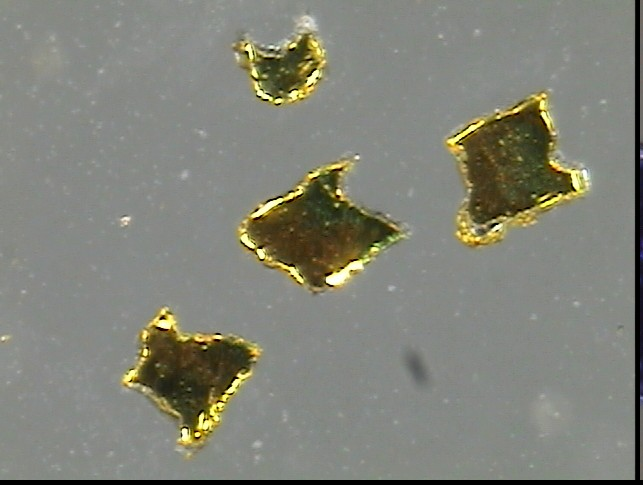
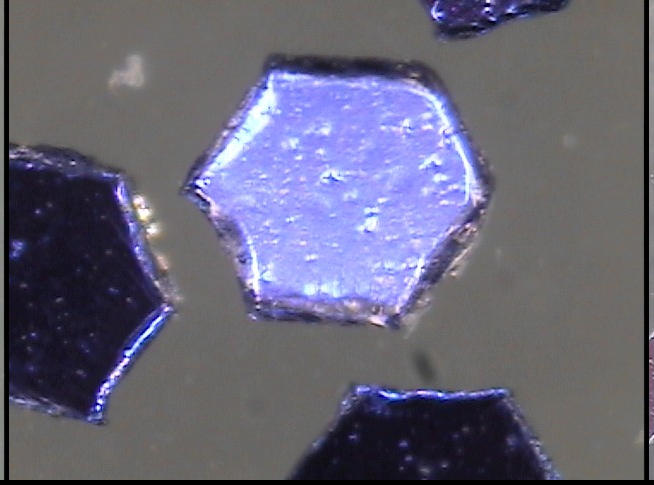
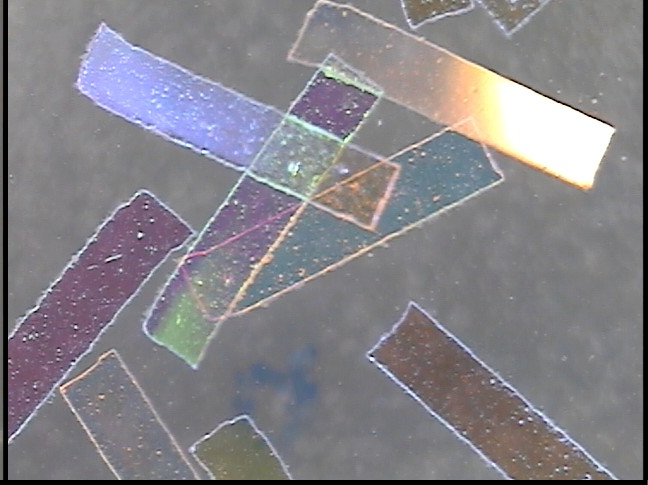
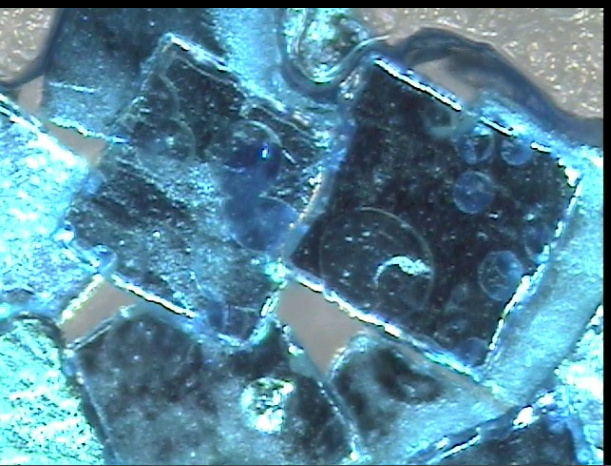
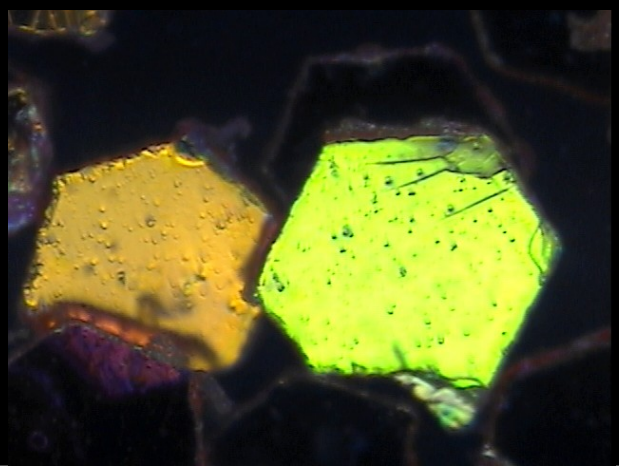
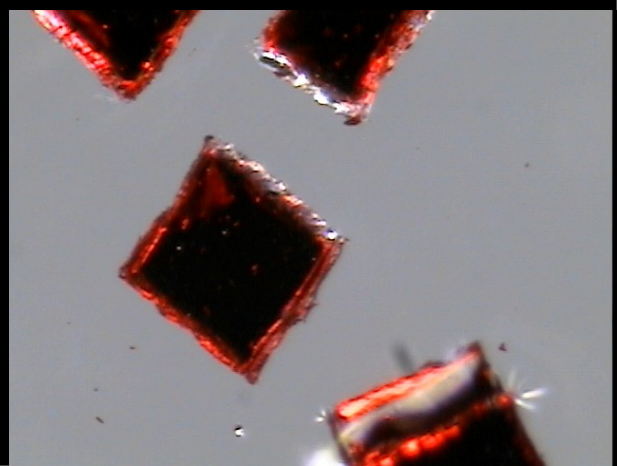




GLITTER as Forensic Evidence

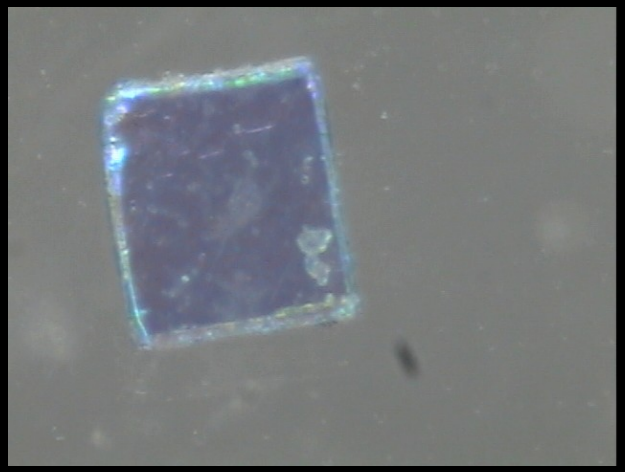
Bob Blackledge
Forensic Chemist

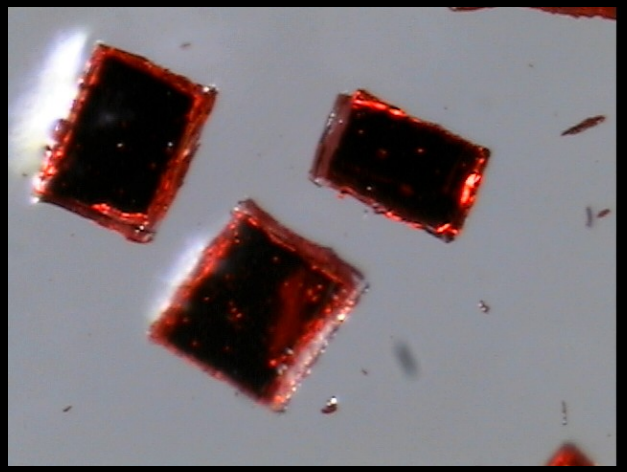




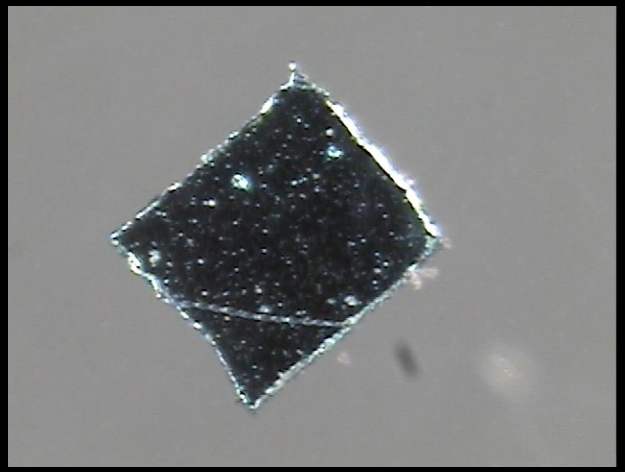
Properties of the Ideal Contact Trace

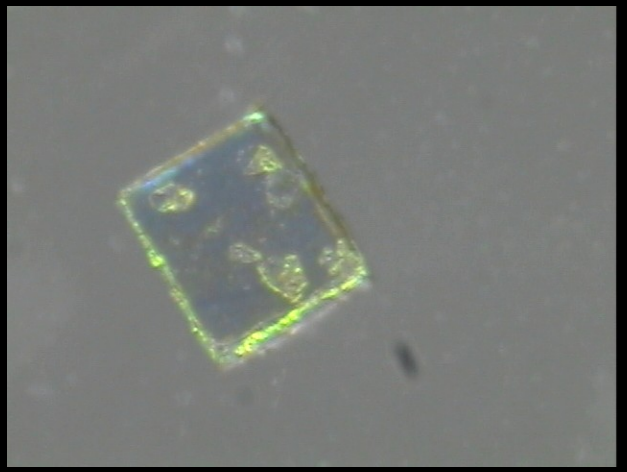
1. Nearly invisible
2. High probability of transfer & retention
3. Highly individualistic
4. Easily collected, separated, & concentrated
5. Mere traces easily characterized
6. Searchable via computerized database
7. Will survive most environmental insults

Color

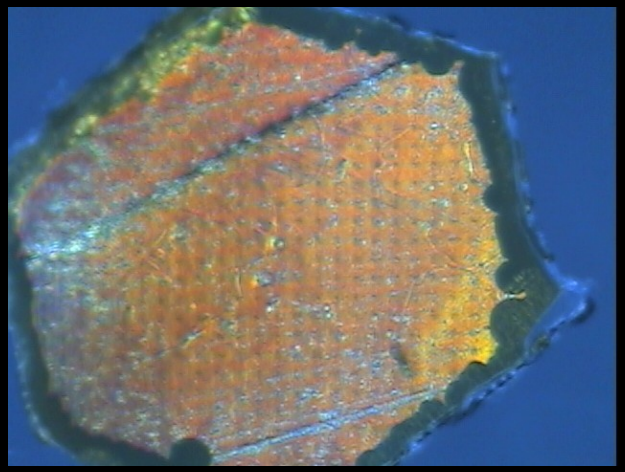


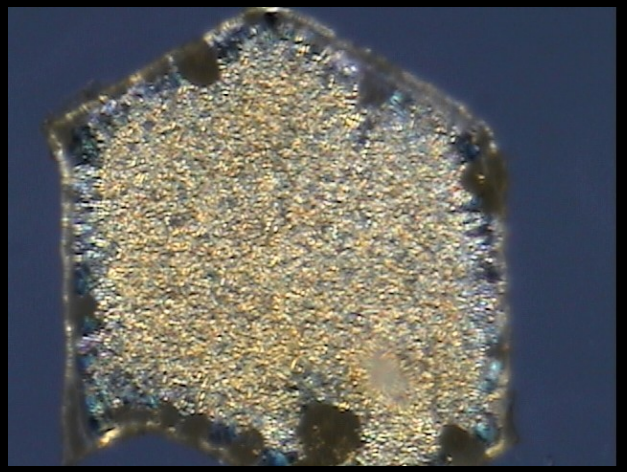


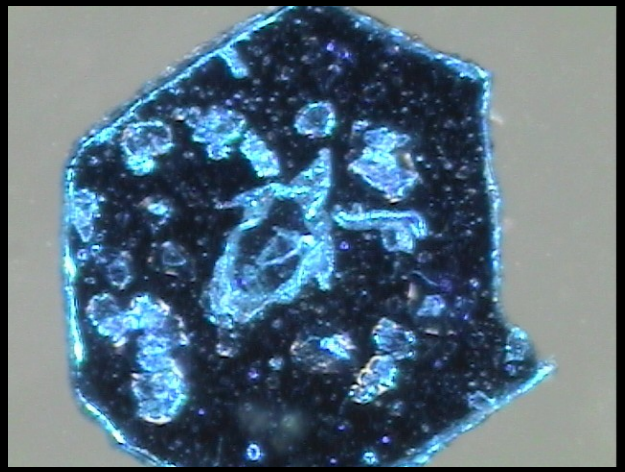


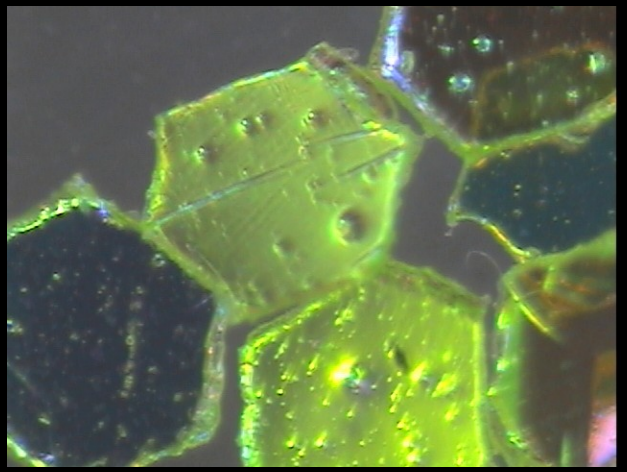


Coatings

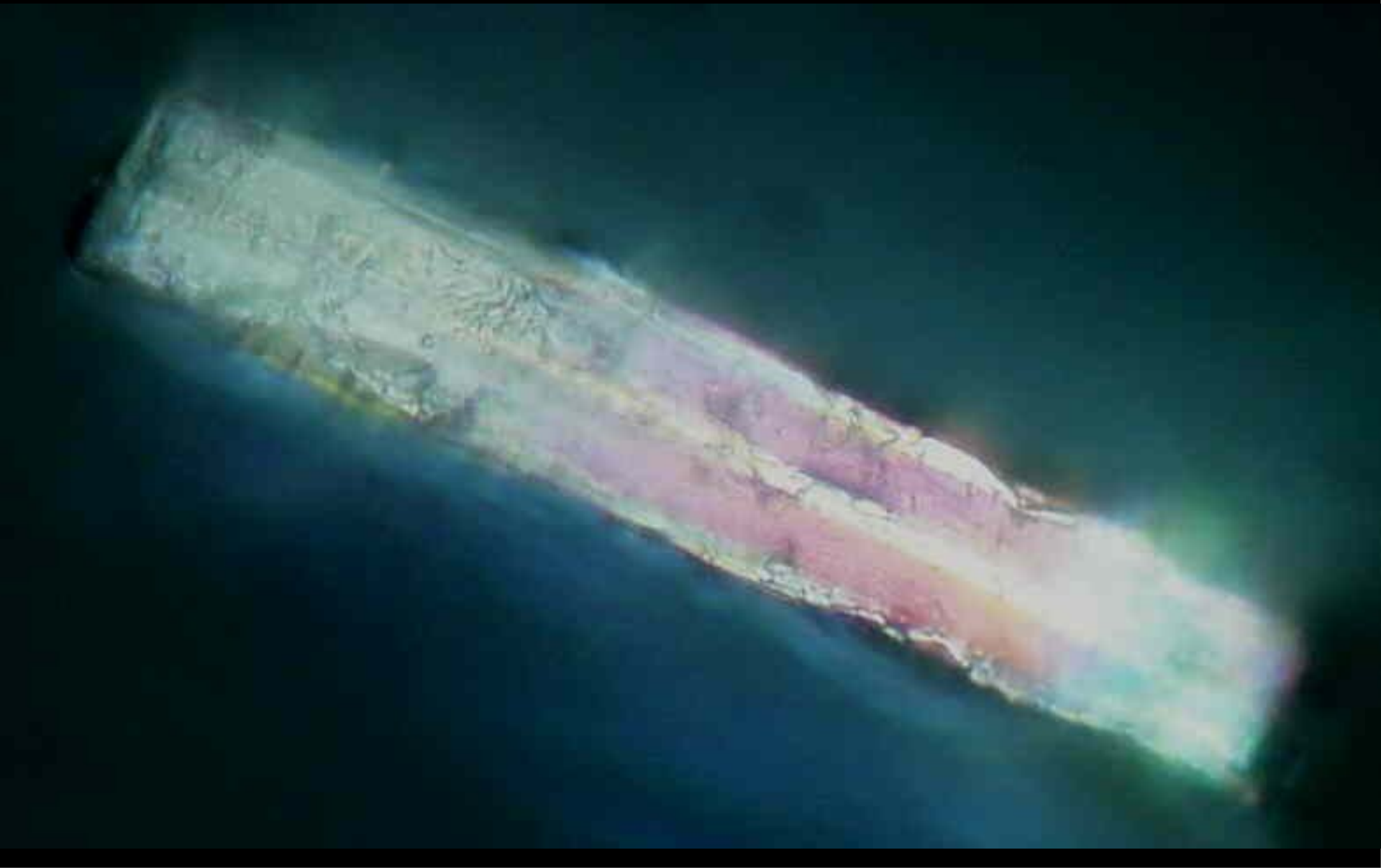


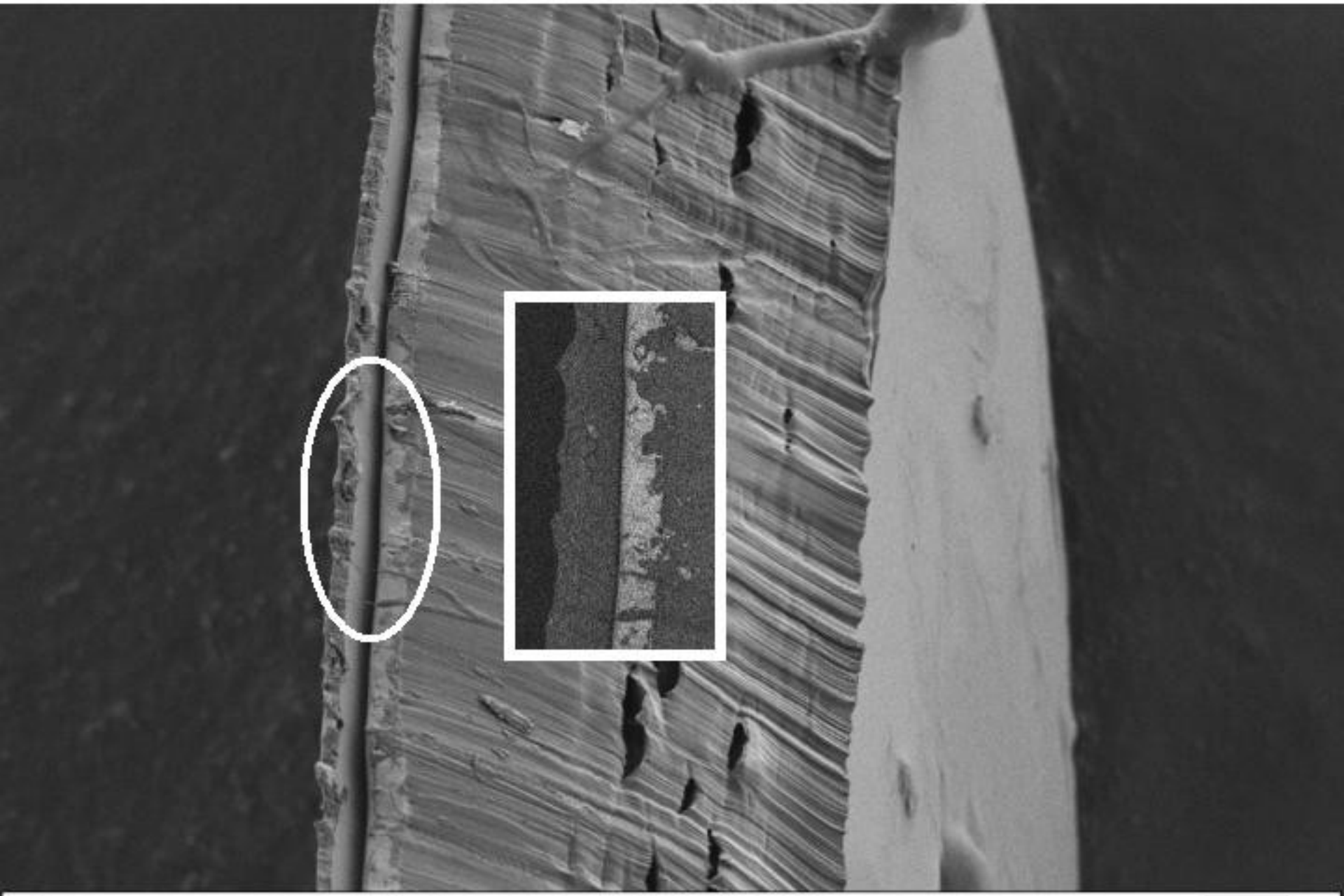






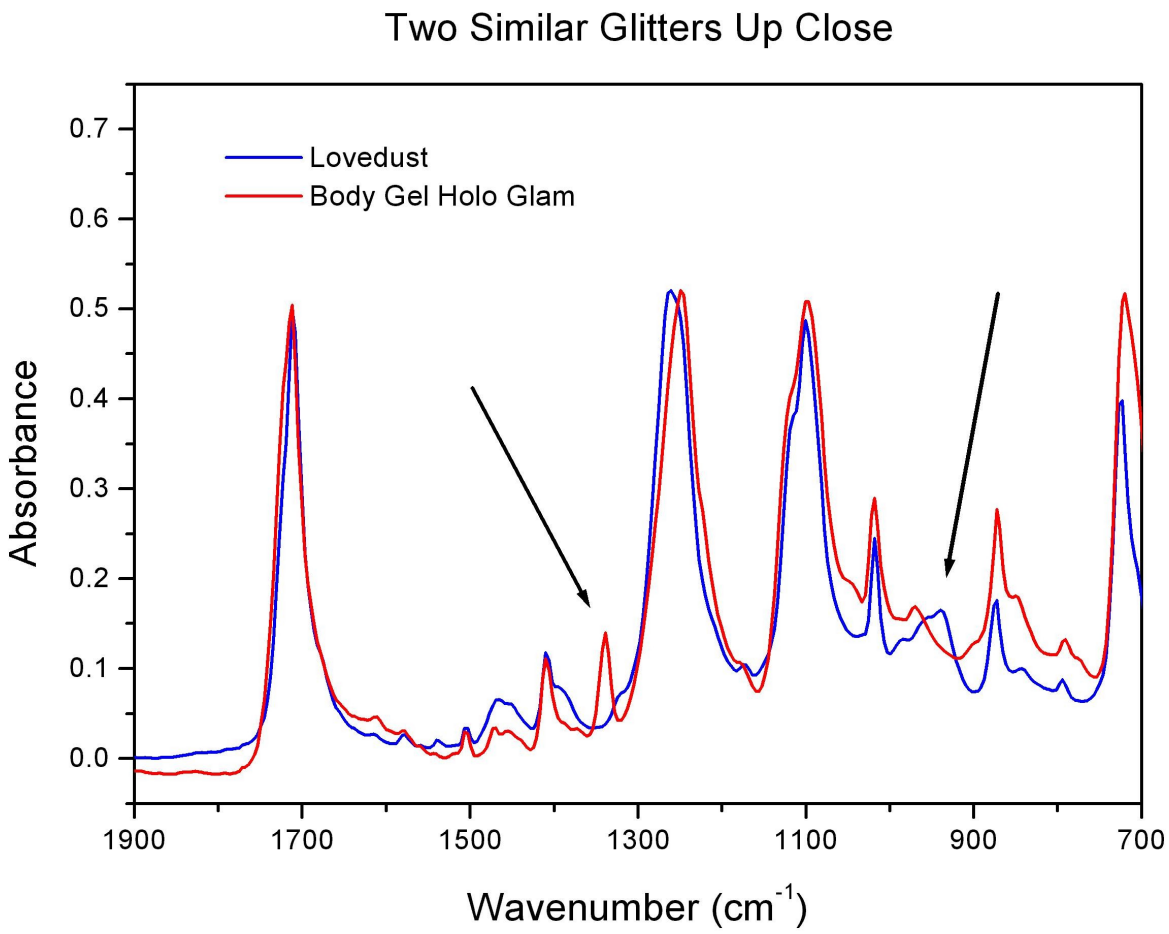
Cross-section



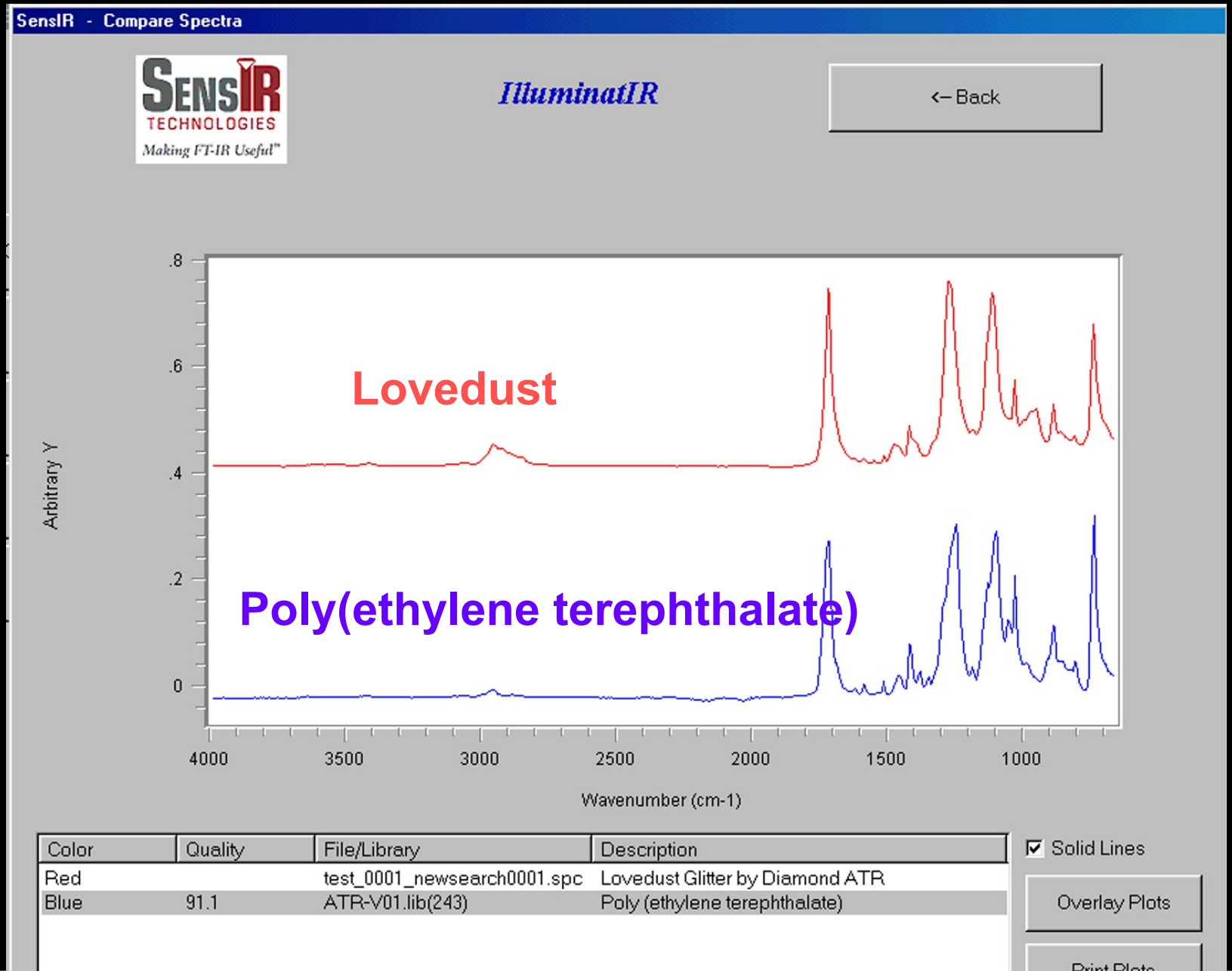

10µm
EHT = 1.00 kV
WD = 6 mm
Signal A = SE2
Photo No. = 298
Date :16 Nov 2005
Time :10:41:14
ZEISS

IlluminatIR®
Smiths Detection, Danbury, CT

Similar ... But Not Identical



“Lovedust” Library Search



Dispersive Raman Microspectroscopy with Confocal Imaging

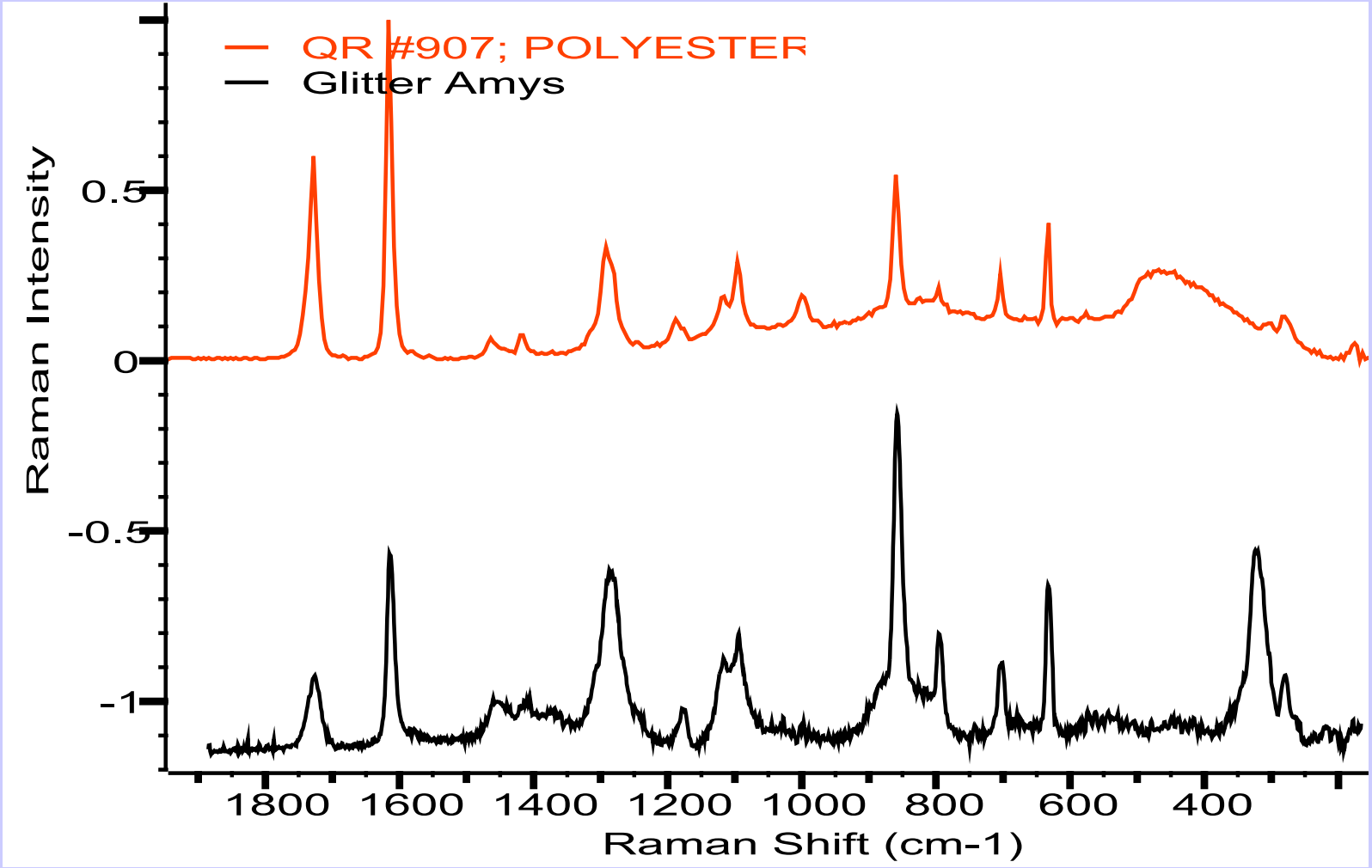
Raman Microspectroscopy

- **The samples were thin, flat platelets and were examined either face-on or by placing the platelet edge-on to the Raman laser incidence for examination of the cross-section.**
- **A JASCO NRS-3100 Raman system fitted with 532nm and 785nm lasers and a motorized (mapping) x-y-z sample stage, was used.**
- **No special sample handling was required.**
- **Standard microscope lenses (X5, X20 and X100) were utilized and the X100 used for actual measurements with a 50μm confocal aperture.**
- **Laser powers were attenuated as appropriate to avoid sample damage by heating, using the build-in OD filter system of the NRS-3100.**

Experimental conditions used

- 100mW 532nm green or 500mW 785nm deep red solid-state lasers
- 1800gr/mm (532nm) or 600gr/mm (785nm) holographic grating
- Dichroic beam splitter used with 785nm
- X100 UMPLFL objective lens
- 100nm precision automated stage

Amy's glitter with polyester search result match



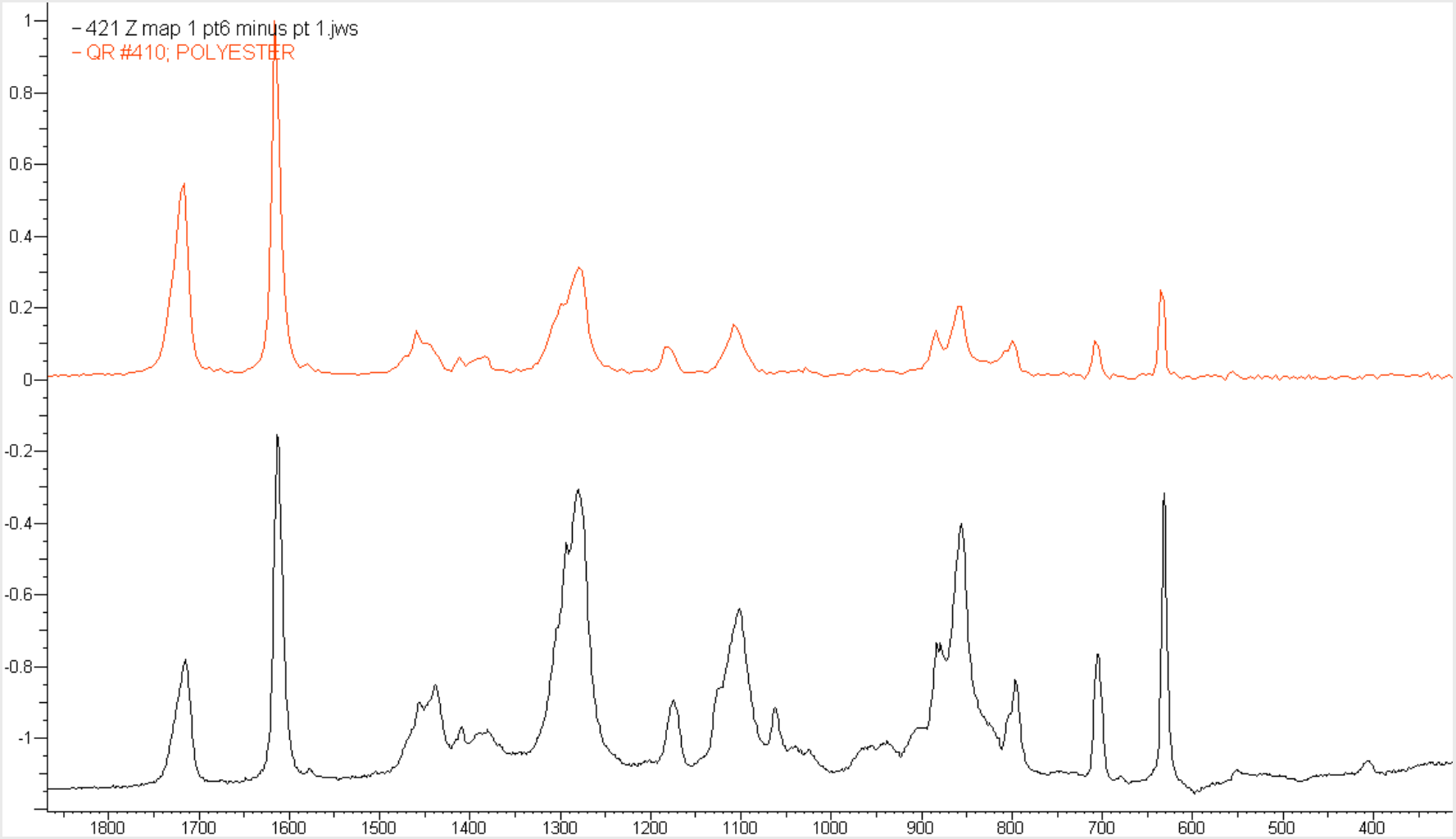
Crystalina 321 and 421

- The Crystalina 300 and 400 series glitters have different polymer layer structures
- To study these different layered samples we used confocal depth mapping
- The samples were probed by changing the sample position relative to the laser spot in 1μm increments, from the surface toward the center
- The focused spot creates an effective sampling volume of approximately 1μm diameter and 2 μm thickness (z)
- The depth resolution is therefore about 2μm
- Both Crystallina samples were confocally mapped as 2-D (x-z) cross sections
- Any metallization present was not thick enough to affect Raman measurements
- Results are shown in the following slides

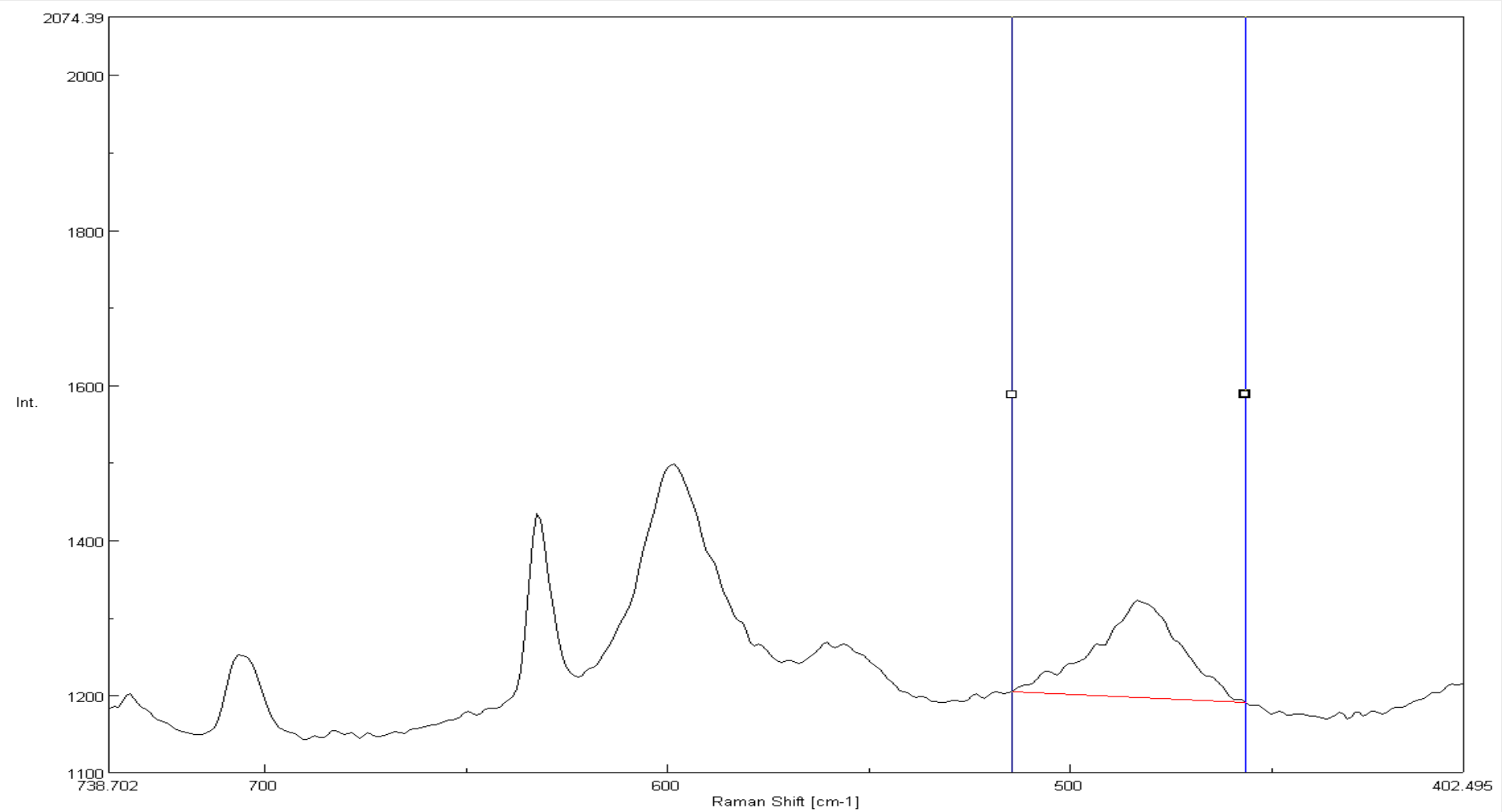
Crystalina 421

- **The 421 glitter has a clearly defined acrylic surface layer of about 3~4μm on a polyester core.**
- **There was some inevitable interference by scattering from the adjacent layers because the effective sampling volume z resolution is about 2μm, so for positive ID we subtracted the adjacent layer spectrum before running the database searches, although for the mapping, raw peak area data were used.**
- **The spectra, database results, and 2-D map data follow.**

Crystalina 421 5µm spectrum with surface spectrum subtracted, and database search result for polyester



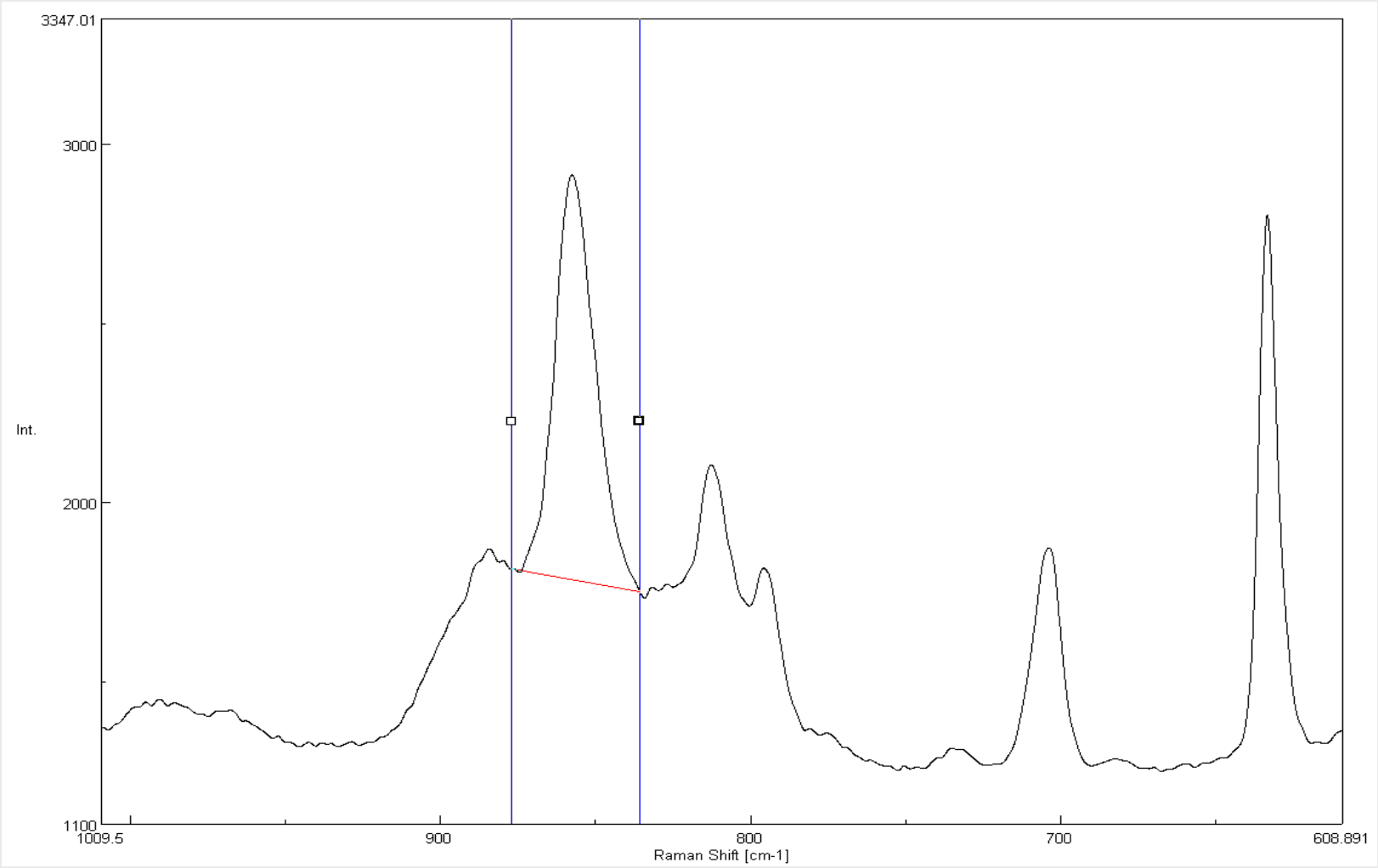
Crystalina 421 peak 2 (PMMA) used to map layer structure



Crystalina 321

- **The structure of Crystalina 321 is less clear-cut than 421 but perhaps more interesting.**
- **The polymers appear to be mixed (copolymer or blended).**
- **The surface is polyester rich, with a shallow layer slightly richer in the acrylic phase and then becoming more polyester rich at 8-10μm depth.**
- **Two peak area ratios were used to follow the layer changes in the x-z confocal map data shown following.**

Crystalina 321 peak area 1



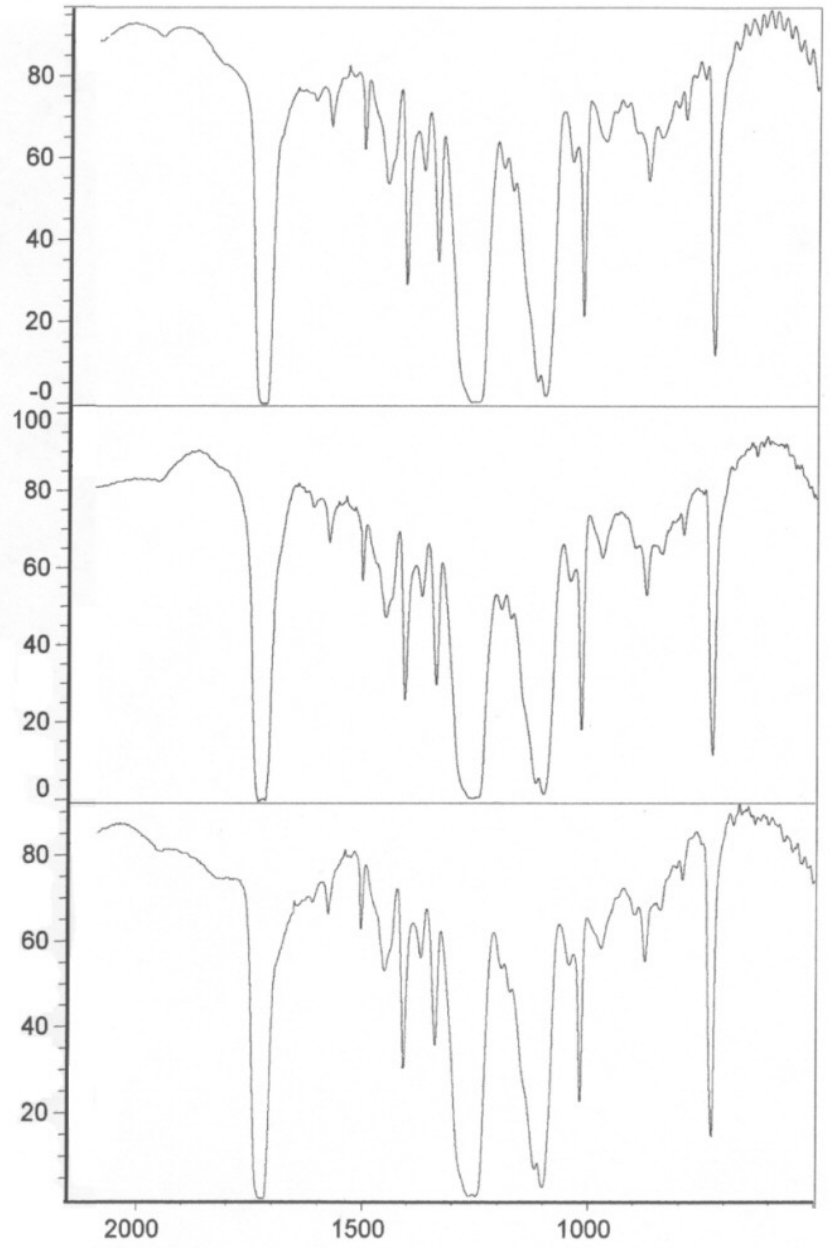
Some case histories: 1) Missouri homicide

Source

Suspect's jeans

Victim's bedspread

Victim's jeans



Case 2: Illinois kidnapping & sexual assault

Case 3: Who was driving?

Many thanks to

Scott Kirkowski **Klaya Aardahl**

Former interns/students who both now have an MFS degree from National University, San Diego

Any questions?