3.9 Fiber Cross-Sectioning

3.9.1 Introduction

The cross-sectioning of fibers can give the examiner diagnostic information for identifying natural fibers and also give discriminating and diagnostic information for man-made fibers. Cross-sectioning can be carried out by two methods: optical cross-sectioning and physical cross-sectioning. The following techniques will cover the physical cross-sectioning of fibers. These techniques can also be used to cross-section hairs and paint.

3.9.2 Safety Considerations

Standard Laboratory Precautions

Chemical	NFPA
Lang's Jet Acrylic liquid	2-2-1
Lang's Jet Acrylic powder	0-1-0
Modeling clay	0-0-0
Petroleum jelly	0-0-0

Sharps Precautions.

3.9.3 Preparations

Standard Laboratory Practices

3.9.4 Minimum Standards & Controls

Both the questioned and standard shall be treated in the same manner.

Joliff method: Use packing threads of a contrasting color to the fiber being cross-sectioned. Do not over pack the plate.

3.9.5 Instrumentation

Stereoscope

Brightfield microscope

3.9.6 Procedure or Analysis

3.9.6.1

Technique 1: Joliff Cross-Section Method.

See **Appendix 3.9 A: Cross Sectioning of Hairs and Fibers** - Joliff Method

3.9.6.2

Technique 2: Methyl Methacrylate Polymer Technique

Materials and Equipment

Petroleum jelly	Glass ring, 5 or 10 mm in height*
Modeling clay	Lang's Jet Acrylic:
Glass slides	Lang Dental Manufacturing Co.
	Wheeling, Illinois 60090-0969
	(847) 215-6622
20 ml beaker	Microspatula
Fine tip tweezers	Stereomicroscope

Sandpaper: 120, 600, 1200 grit, cut into half-sheets	Micro hot plate

*The top of polyethylene vial stoppers can cut down and substituted for the glass ring.

Using the stereomicroscope:

- Place a small piece of modeling clay onto a half glass slide.
- Use tweezers to pick up and very gently press the fiber or hair into the clay.
- Smear a small amount of petroleum jelly onto the middle of another glass slide and also on the inside of a glass ring. Place the glass ring onto the lubricated area of the glass slide.
- Pour a small amount of Jet Acrylic powder into a 20 ml beaker.
- Add several drop of Jet Acrylic liquid to the powder and stir with the microspatula. Add enough liquid to make it thick, yet thin enough to pour out the beaker. (Ventilation may be desirable if the odor of the volatile liquid is bothersome.)
- Pour the acrylic into the glass ring on the slide. This makes a mold to form an acrylic tablet.
- Allow the acrylic to set up a little so it is not runny.
- Work quickly and use the tweezers to pick off the sample from the modeling compound and immerse it into the acrylic. Push the sample all the way down to touch the glass slide. The sample will stay upright on its edge if the acrylic has thickened enough. If acrylic is too runny, take the sample out and wait a few more seconds before trying again.
- If you are working with a very small sample and poured only a 2 mm depth of acrylic into the ring, you now can make a new mix and pour it over the first one with the sample in it and fill the ring up to the top.
- Allow the mold to dry. A little heat will speed up the initial drying process. Place the slide on a micro hot plate, set at 200?, for 15 seconds. If over-heated, air bubbles will form.
- Depending on ambient temperature and humidity, the acrylic tablet will dry completely hard and clear in 15 to 20 minutes.
- Before the tablet is totally dry, it can be separated from the glass ring by pushing from the top with the microspatula. The petroleum jelly lubrication with lessen the effort of separation. If the tablet sticks to the glass slide, separate it with a scalpel.
- Use hot water and soap to clean up the glass beaker, slide, and ring.
- Starting with the 120 grit sandpaper, begin polishing the surface that faced the glass slide. Hold the tablet in your fingertips and, with pressure, move it in a figure 8 to expose the sample. Through each step of sanding, inspect the sample using the stereomicroscope.
- Move to the 600 grit wet/dry paper with a drop of water smooth out the surface and to polish the sample.
- Use the 1200 grit paper with a drop of water to put a very smooth surface on the tablet and the sample.
- Turn the tablet over and place the unpolished face down on glass slide. The sample is now ready to photograph using a compound microscope and camera system.

3.9.6.3

Technique 3: Polyethylene film method

- Lay fiber(s) between two thick pieces of polyethylene film, which are cut small enough to fit on a glass slide.
- Place fiber "sandwich" onto a glass slide with another glass slide on top
- Heart on hotplate (medium heat) until the polyethylene plastic has melted around the surface of the fiber. Do not use extremely high temperatures, as the fiber may melt
- After cooling, remove the top slide. With a scalpal or razor blade, cut cross sections of the fiber(s)

3.9.6.4

Cross sectioning may be accomplished using any other method which will produce cross sections which allows for physical observation of the cross section

3.9.7 References

Skirius, Stephen, "Fiber Cross-Sections", Microscope, 34 (1), 26, 1986.

Welsh, Frank S., "A Polished Paint Layer Crosssection in 30 Minutes",Microscope, 45 (2), 37-40, 1997.