3.7 Fibers Solubility

3.7.1 Introduction

The solubility of man-made fibers in specific liquids and the fibers optical properties allows an examiner to identify the generic class of the fiber. Solubility tests seldom allow an examiner to identify the sub-generic class of a fiber and it also destroys the sample used in testing. For those two reasons, other non-destructive test should be run if the sample is of sufficient size.

3.7.2 Safety Considerations

Standard Laboratory Precautions

Chemical	NFPA
acetic acid, glacial	3-2-1
acetone	1-3-0
acetonitrile	2-3-0
chloroform	2-0-0
cyclohexanone	1-3-0
dimethyl formamide (DMF)	1-2-0
formic acid	3-2-0
hexafluoroisopropanol	3-0-0
Hydrochloric acid, conc.	3-0-0
nitric acid, conc.	3-0-0
sulfuric acid, conc. & 75%	3-0-2
water	0-0-0

3.7.3 Preparations

Standard Laboratory Practices.

3.7.4 Minimum Standards & Controls

The questioned and known fibers shall be examined in the same manner.

3.7.5 Instrumentation

Stereomicroscope or an old brightfield microscope dedicated to solubility testing.

3.7.6 Procedure or Analysis

Refer to **Appendix 3.7 A**: HFIP Solubility Flowchart

Refer to **Appendix 3.7 B**: Formic Acid Solubility Flowchart

Refer to **Appendix 3.7 C**: General Fiber Solubility Table

Select one of the above solubility charts. Starting at the top and working downward, conduct solubility tests in the following manner. The fiber's optical properties may eliminate some steps.

- Place a small piece of the fiber on a microscope slide.
- Cover with a coverslip and place on a microscope.
- Focus on the fiber.
- Allow the selected reagent to run under the coverslip and react with the fiber.
- Observe whether the fiber is soluble, insoluble, swells, gels, or shrinks.
- Compare results with the selected chart and proceed to the next step.
- Continue until fiber is identified.

Key to Solubility Reactions:

S	=	Soluble (fades, splinters, or breaks apart and goes into solution)
SW	=	Swells

G	=	Gels (Plasticizes)
P or PS	=	Partly Soluble (not all portions of a fiber or not all fibers within a group of like fibers are soluble within 5 minutes)
F or Fan	=	Ends "fan" or "mushroom" (damaged areas also swell)
B	=	"Balloons" (forms large swellings with unswollen bands between the swellings)
SC	=	"Spinal Column" (a fast SW/G into a form which resembles the series of small bones forming a human "backbone")
I	=	Insoluble (no reaction)

3.7.7 References

Gaudette, B. D. In Forensic Science Handbook; Saferstein, R., Ed.; Prentice Hall: Englewood Cliffs, N.J., 1988; Vol. II, Chapter 5.

Robertson, J., Ed. Forensic Examination of Fibers; Ellis Horwood: New York, 1992.