Microscopic Analysis

The microscope is an extremely useful instrument in the examination of physical evidence. Most common is the optical microscope. With experience, a forensic microscopist can determine many specimens including glass, fibers, hair, paint chips, minerals, food particles, and more and can also run small chemical identifications and spot tests..

The types of optical microscopes are:

> The **compound microscope**. This is the type most students may be accustomed to from a high school or college biology course. Magnifications usually cover the range of about 100x to 1000x. This is the instrument most commonly used to examine small samples.
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> The **comparison microscope**. This is essentially two compound microscopes combined into one unit by a bridge incorporating a series of lenses and mirrors to observe two specimens in a side-by-side comparison.
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> The **stereoscopic microscope** provides magnifying powers from 10x to 125x allowing a distinctive three-dimensional image of an object and is useful in examining large, bulky items.
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> The **polarizing microscope** is a compound microscope fitted with two polarizing filters. The lower polarizing filter is placed in the light beam below the specimen and the second filter, the analyzer, is placed in the eyepiece. Normally, the two filters are crossed or almost crossed to allow identification of minerals, fibers, and small particles by their birefringence (i.e., different refractive indexes in different directions). A collection of photomicrographs, known as *The Particle Atlas*, by Wlter C. McCrone, et. al., can allow an experienced microscopist to identify thousands of materials using the polarizing microscope.
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> The **microspectrophotometer** is an optical microscope linked to a computerized spectrophotometer. Depending on the light source used, a forensic analyst can obtain both a visual image and a visible or infrared spectrum of a sample.

The **scanning electron microscope** (SEM) uses a beam of electron to produce images with a magnification from 10x to 100,000x with greater depth of field than an optical microscope. Coupled with an x-ray analyzer, it can be used to identify the chemical elements in a sample, such as gunshot particles from a suspect's hands.

Comparison of Paper Matches

This investigation will examine paper matches, found at a "crime scene" with books of matches obtained from searches of the clothing and apartments of three suspects.

Materials

> Microscope, stereoscopic 30x or 40x, or small illuminated 30x microscopes
> Match books and match

Safety Precautions

There are no safety hazards in this procedure.

Procedure

You will be given a paper match and several matchbooks.

Compare the color, width, and thickness of the matches.

Using the microscope, try to identify which of the match books the separate match came from. Compare the matches side by side for similar characteristics.

The matches will show similarities on both the tops sides and the bottom sides of the matches.

Look at the side of the match as it compares to the match that would have been next to it.

Look at the base of the match and compare it to the strip on the bottom of the matchbook from which it may have been torn from.

Explain how you arrived at your conclusion as to which matchbook the match may have come from.

Comparison of Paint Chips

This investigation will examine paint chips from a hit-and-run auto accident where a parked car was sideswiped. Three suspect cars of similar color, and style have been located, but, since they are older cars, all three have a number of scratches and dents on them. You have been given paint chips from each of the tree suspect cars and from the vehicle that was hit.

Materials

Microscope, stereoscopic 30x or 40x
Paint chips
Modeling clay
Forceps
White cardboard or heavy white paper
Small knife or single edge razor blade

Safety Precautions

Exercise care handling the knife or razor blade.

Procedure

Place a piece of white cardboard or heavy paper on the microscope stage.

Obtain a small piece of modeling clay, about the size of a pea. Shape in like a small pyramid and place it on the paper or cardboard.

Make a small slit in the top of the clay with a knife or razor blade.

Handling a paint chip with forceps, place it in the slit on the clay so that no more than half the paint chip is in the clay and its edge is up. Gently squeeze the clay together to hold the paint chip in place.

Repeat this procedure with the other paint chip samples.

Compare the paint chips. Paints, particularly on wood and metal are composed of layers such as surface sealers, rust proofing, undercoats, the top coat, and a clear coat, depending on the object painted. Look for layers and colors on the paint chips.

Explain how you arrived at your conclusion as to which paint chip matches with the chip recovered from the parked car that was hit.