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Use of Narrow-Band-Pass Filters to Enhance Detail in Latent Fingerprint Photography by Laser

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ABSTRACT: The barrier filter used to date to photograph fingerprints by laser does not eliminate substrate luminescence that can reduce or destroy the value of the fingerprint. Use of a narrow-band-pass filter with an appropriate transmission spectrum can often isolate the desirable fingerprint luminescence and yield a better photograph of the print.

KEYWORDS: criminalistics, fingerprints, photography, lasers, narrow-band-pass filters

In earlier papers [*1,2*] a method for photographing laser-induced luminescence of fingerprint residue was described. A lens from the protective laser goggles was placed at the lens of the camera to isolate desirable luminescence. In this way the fingerprints could be photographed as they were seen.

It has been noted, however, after three years of exhibit examination, that the desired luminescence may be difficult to record. This is a result, in the writer's opinion, of two factors. First, the luminescence may be extremely weak. Second, the substrate may luminesce at a wavelength and intensity similar to those of the fingerprint, making it difficult to obtain a useful photograph. Narrow-band-pass filters may be used to enhance the contrast between fingerprint and substrate.

Procedure

As indicated previously, all-lines lasing was employed. A Control® Model 558A argon-ion laser with an approximate power of 6 W was used. In Case 1 a red pencil crayon of unknown origin was used to initial and date the fingerprint. In Case 2 the fingerprint was marked with a Berol Prismacolor® #921 pencil crayon. When fingerprints are recorded by laser, it is advantageous to mark them with a pencil crayon or ink, the luminescent intensity of which closely approximates that of the fingerprint. This ensures that one exposure will correctly record both print and marking. Most of the inks and markers sampled luminesced so intensely that when recorded on a negative exposed for the fingerprint, they were so grossly overexposed as to be illegible.

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Photography

Figure 1 illustrates the procedure by which good results were initially obtained with the laser goggles filter (Fisher, 11-409-50A) in photographing laser-induced luminescence. Exposure was determined with a Pentax Digital Spotmeter by reading through the filter (Fig. 2). The narrow-band-pass filters were used in the same way to determine exposure.

Case 1

Report

A beer bottle was examined by laser and found to bear a fingerprint on the label. Although much of the ridge detail was easily visible when viewed by laser, the central portion of the print was extremely faint and, in addition, was obstructed by background luminescence. It was first photographed using the original method (Fig. 3A).

Next, a Melles Griot (Irvine, CA) 03-FIV-079 narrow-band-pass filter was used as a barrier filter at the camera lens and a photograph was taken (Fig. 3B). The procedure was repeated with a Melles Griot 03-FIV-041 filter (Fig. 3C).

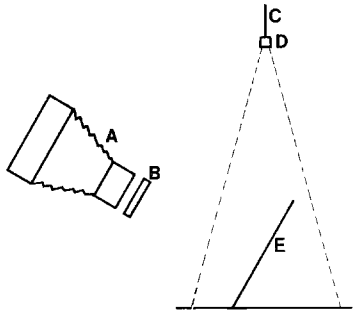


FIG. 1—A, *Camera;* B, *barrier filter (Fisher, 11-409-50A);* C, *laser beam;* D, *beam expansion optics; and* E, *exhibit.*

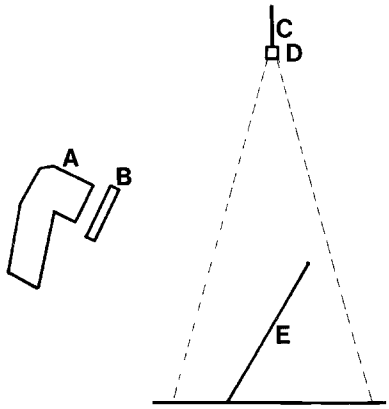


FIG. 2—A, *light meter;* B, *barrier filter;* C, *laser beam;* D, *beam expansion optics; and* E, *exhibit.*

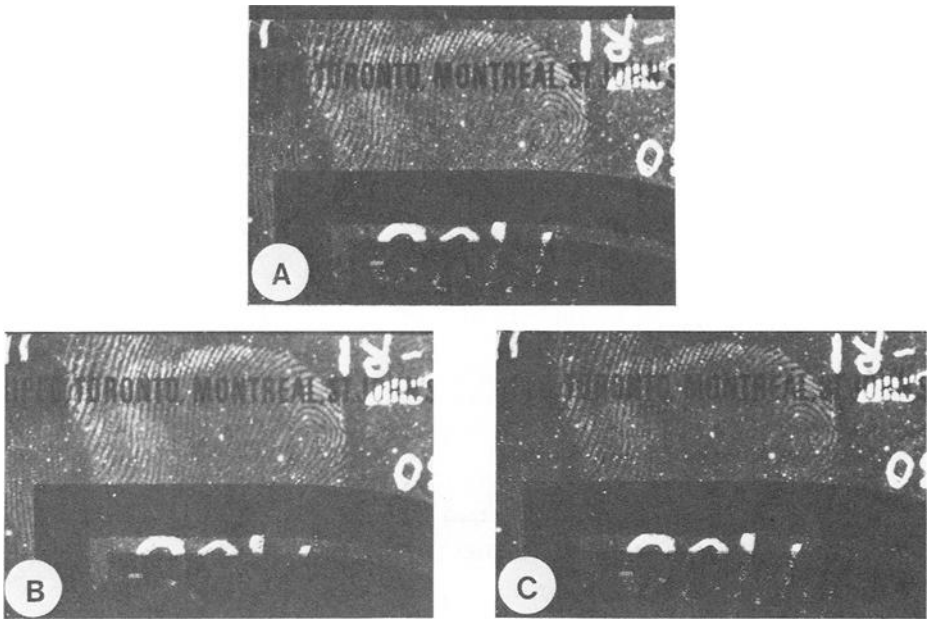


FIG. 3—*Case 1 photographed with* (A) *Fisher 11-409-50A,* (B) *Melles Griot 03-FIV-079, and* (C) *Melles Griot 03-FIV-041 filters.*

Figure 4 illustrates the transmission spectra of the three filters used.

The photographs were taken on Ilford FP4 film (ASA 125) and developed in Kodak D-11 developer at 20°C for 4 min with continuous agitation.

Observations

Consistent with the visual examination, the 11-409-50A recording shows clear ridges on the perimeter but somewhat muddled detail in the central portion of the fingerprint. The 03-FIV-079 recording, however, has clarified the central detail and rendered it suitable for comparison. The 03-FIV-041 recording shows the central detail obstructed by background luminescence in a fashion similar to that of the 11-409-50A recording (Fig. 3A). Of the three filters, the 03-FIV-079 has yielded the most useful recording of the fingerprint because the central portion can be used for comparison and the detail is continuous from one side of the print to the other.

Case 2

Report

A Canadian ten dollar bill was examined by laser and one fingerprint was located. It was photographed by using as barrier filters 11-409-50A (Fig. 5A), 03-FIV-079 (Fig. 5B), and 03-FIV-041 (Fig. 5C). The recordings were made on Kodak Contrast Process pan film (ASA 80) and processed in Kodak D-11 developer at 20°C for 4 min with continuous agitation.

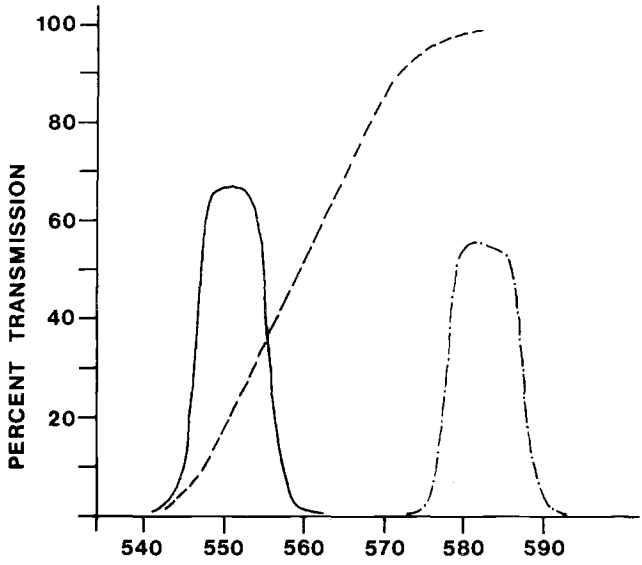
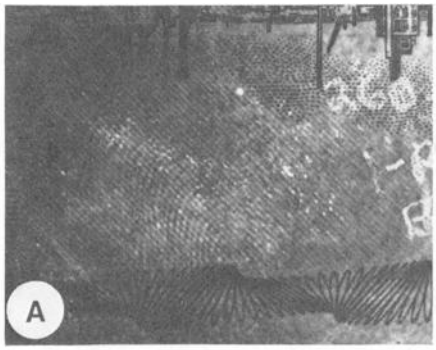
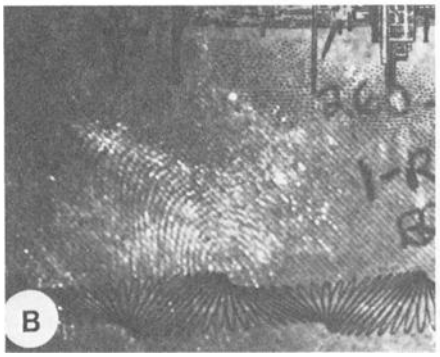


FIG. 4—*Transmission spectra of Fisher 11-409-50A* (------), *Melles Griot 03-FIV-079* (————) *and Melles Griot 03-FIV-041* (—•—•—•—) *filters.*





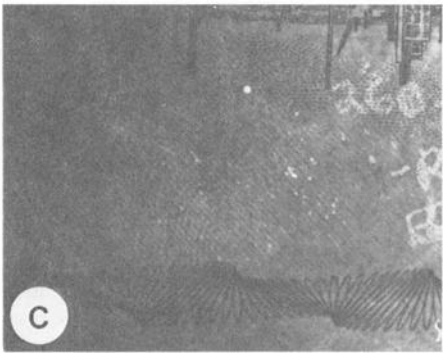


FIG. 5—*Case 2 photographed with* (A) *Fisher 11-409-50A*, (B) *Melles Griot 03-FIV-079, and* (C) *Melles Griot 03-FIV-041 filters.*

Observations

Once again, the 03-FIV-079 filter has yielded the best results. The ridge detail in the recording exhibits much better contrast and the interfering luminescence from the background is significantly diminished.

The ridge characteristics in the 11-409-50A recording are not clear because of this interference. The 03-FIV-041 filter has subdued the background but has also almost eliminated the fingerprint.

It will be noted, as a point of interest, that the marker used in Case 2 underwent a radical change in tonal rendition on the photograph with the change in filters.

Conclusions

1. In cases where a laser fingerprint is extremely faint and degraded by background interference, narrow-band-pass filters may be used to advantage. Although the effect of the use of the filter is not always overpowering, it is the writer's opinion that it may be the deciding factor in a fingerprint being unsuitable or identified.

2. Although the Melles Griot 03-FIV-079 filter yielded the best results, fingerprint luminescence has been noted in the yellow, orange, and even red regions of the spectrum. Depending on the spectral nature of the background and the luminescence wavelength of the fingerprint, filters with different transmission characteristics may be required. It may be necessary to photograph a fingerprint with several different filters to determine which will yield optimum results.

3. Some fingerprints luminesce so faintly that determining exposure with the meter as shown in Fig. 2 may not be possible. Long trial exposures of 10 min or more are not uncommon.

References

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[2] Dalrymple, B. E., "Case Analysis of Fingerprint Detection by Laser," *Journal of Forensic Sciences*, Vol. 24, No. 3, July 1979, pp. 586–590.

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