

TECHNICAL NOTE

Yehuda Novoselsky,¹ B.Sc.; Baruch Glattstein,¹ M.Sc.; Nikolai Volkov,¹ M.D.; and Arie Zeichner,¹ Ph.D.

Microchemical Spot Tests in Toolmark Examination

REFERENCE: Novoselsky, Y., Glattstein, B., Volkov, N., and Zeichner, A., "Microchemical Spot Tests in Toolmark Examinations," *Journal of Forensic Sciences*, JFSCA, Vol. 40, No. 5, September 1995, pp. 865–866.

ABSTRACT: The use of spot tests to find traces of metals quickly on the cutting regions of the tool blades submitted for toolmarks comparison is reported. Two cases are presented. The cutting of a padlock by a bolt cutter and the cutting of electric wire by fingernail clipper.

KEYWORDS: criminalistics, toolmarks, trace metals

Various cutting tools are used in the commission of crimes, for instance: bolt cutters for cutting padlocks, cutters and scissors for cutting electric wires etc. In order to link the tools seized from the suspects to the cut exhibits, one has to compare the marks left on the exhibits to the marks produced by the suspected tools. In the case that the cutting blade is relatively long compared to the cut region in the exhibit it may be necessary to carry out many test cuts to find the region of the blades that cut the exhibit. In the cases where the metal of the exhibit is different from the steel of the tool's blades, it may be useful to apply a spot test for the metal traces left by the exhibit on the suspected tool in order to quickly locate the cutting region of the tool's blades.

To the best of our knowledge, there are no reports in the literature on using spot tests for the above purpose. Obviously, the spot test may be useful whenever the metal traces cannot be observed visually or microscopically. Also the spot test will be of limited value if the suspected tool was used with a variety of metals before or after cutting the exhibit in question.

The objective of this work was to demonstrate in two cases the use of spot tests for detection of cutting regions on the tools' blades.

Case Examinations—Experimental Procedure

Case 1

We were asked to link a bolt cutter seized from the suspect to a cut padlock found at the scene of an attempted burglary. It was

Received for publication 22 July 1994; revised manuscript received 24 Oct. 1994 and 28 Jan. 1995; accepted for publication 31 Jan. 1995.

¹Scientific Officers and Head, Toolmarks and Materials Laboratory, respectively, Division of Identification and Forensic Science, Israel Police Headquarters, Jerusalem, Israel.

found that the steel shackle of the padlock had a zinc coating. Therefore a spot test for zinc could be useful in this case.

The spot test was based on the detection of small amounts of a nitrate by its reduction to a nitrite using a zinc metal in acidic medium and detection of the nitrite by the Griess reaction [1]. The spot test was carried out as follows.

A few drops of a solution of 4% sodium nitrate A.R. (nitrite free) in 10% phosphoric acid in water were placed on a piece of a Benchkote (Whatman) filter paper. {The Benchkote filter paper (Whatman) was found to be the most appropriate substrate for spot tests to detect bullet holes [2]}. The paper was pressed for about half a minute on the blades of the bolt cutter, marking the edges of the blades on the plastic (opposite) side of the paper. The paper was removed and a few drops of a modified Griess reagent [3] (a solution of freshly prepared 4% sulfanilamide and 0.2% N-1 naphthylethylenediamine dihydrochloride in 10% phosphoric acid were placed on the paper. A red-violet color was developed in a small part of the full length of the bolt cutter's blades (Fig. 1). A positive comparison of the toolmarks produced by the above part of the blades and the marks on the cut shackle was obtained. It is worthwhile to mark the colored region, since after a while all the area where the reagent was applied gets a red violet color.

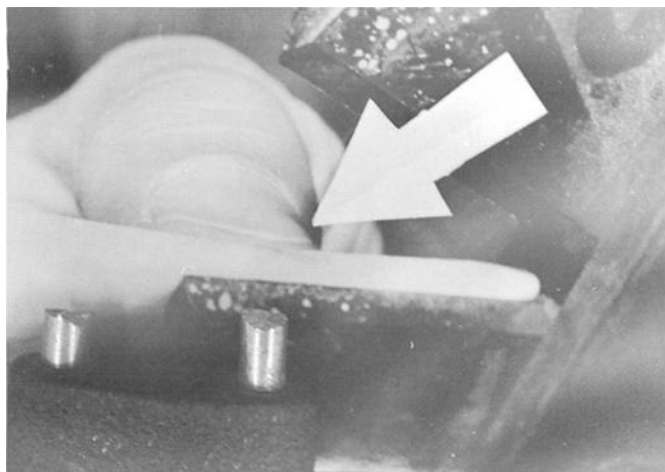


FIG. 1—Development of a red-violet color on a Benchkote filter paper in the case of bolt cutters and a padlock. The arrow pointing to the colored area.

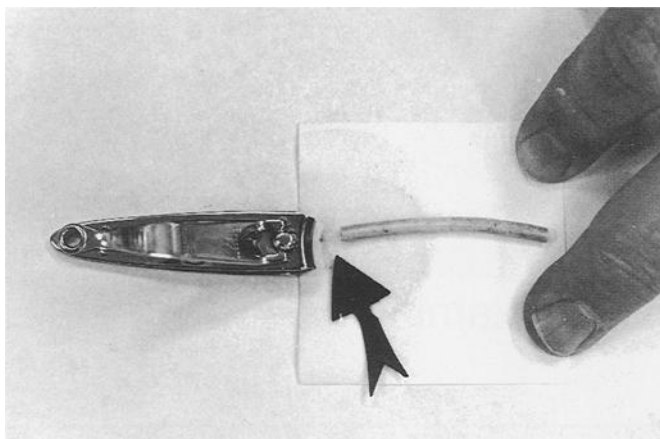


FIG. 2—Development of green-black color in the case of fingernail clipper and electric wire. The arrow pointing to the colored area.

Case 2

In a proficiency test we were asked to examine whether a fingernail clipper was used to cut an electric wire. In this case a spot test for copper using rubeanic acid [1,2] was used in a similar way to that described in the case 1 as follows.

Few drops of 10% ammonium hydroxide aqueous solution were placed on a piece of a Benchkote filter paper. The filter paper was pressed for about half a minute on the blades of the clipper, while marking the edges of the blades. The paper was removed and a few drops of 1% alcoholic solution of rubeanic acid [1] were

placed on the paper. A green-black color was developed in a small part of the clipper's blades. The result is shown in Figure 2. Also in this case a match was found between the marks produced by the detected region of the clipper's blades and the marks found on the cut electric wire.

Conclusion

It was demonstrated, in two cases, that spot tests for various metals may be efficient in quickly locating the region of tool used to cut various objects.

Acknowledgment

The authors would like to express their thanks to superintendent A. Gorski of the Division of Identification and Forensic Science for his help in preparing the manuscript.

References

- [1] Feigl, F., Anger, V., and Oesper, R. E., *Spot Tests in Inorganic Analysis*, 6th ed., Elsevier, 1972, pp. 363, 213–215.
- [2] Steinberg, M., Leist, Y., and Tassa, M., "A New Field Kit for Bullet Hole Identification," *Journal of Forensic Sciences*, Vol. 29, No. 1, 1984, pp. 169–176.
- [3] Almog, J., Kraus, S., and Glattstein, B., "ETK—An Operational Explosive Testing Kit," *Journal of Energetic Materials*, Vol. 4, 1986, pp. 159–167.

Address requests for reprints or additional information to
Baruch Glattstein, M. Sc.
Division of Identification and Forensic Science
Israel Police Headquarters
Jerusalem 91906, Israel.