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TECHNICAL NOTE

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Dynamite Contamination of Blasting Cap Leg Wire Insulation

Infrared absorption spectrophotometry with a diamond cell sample holder is routinely employed in our laboratory for the examination of plastic wire insulation. The determination of the type of polymer used as insulation on electric blasting cap leg wire allows the manufacturer of the cap to be identified [*1*].

In a recent case, infrared (IR) examination of a portion of insulation from suspected blasting cap leg wire showed four absorption bands in the spectrum which were not attributable to the expected polymer materials (Fig. 1). These bands were observed at approximately 840, 890, 1270, and 1650 cm^{-1}, which are the principal bands seen in the IR spectra of chloroform extracts of commercial dynamite [*2*].

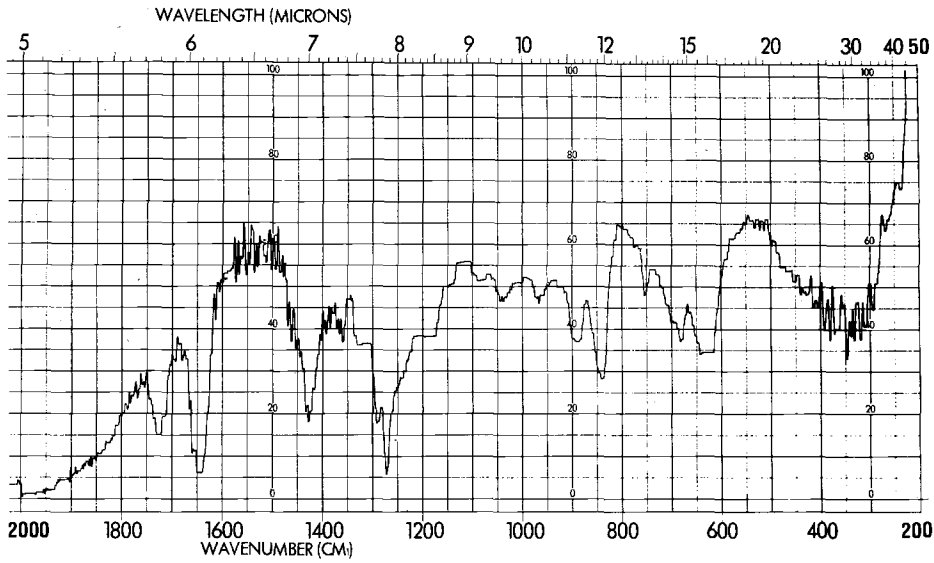

FIG. 1—*Leg wire insulation showing dynamite contamination.*

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We had previously noted the ease with which ethylene glycol dinitrate (EGDN) from commercial dynamite migrates through plastic evidence bags [*3*]. It was postulated that the blasting cap and its associated leg wires may have been improperly stored with commercial dynamite for a time sufficient to allow adsorption of the nitrate esters EGDN and nitroglycerin (NG) onto the surface of the wire insulation. To remove adsorbed volatile materials, the sample was heated in a convection oven maintained at 75 °C for 2 h and the IR spectrum obtained (Fig. 2). In the heated sample, the extraneous bands

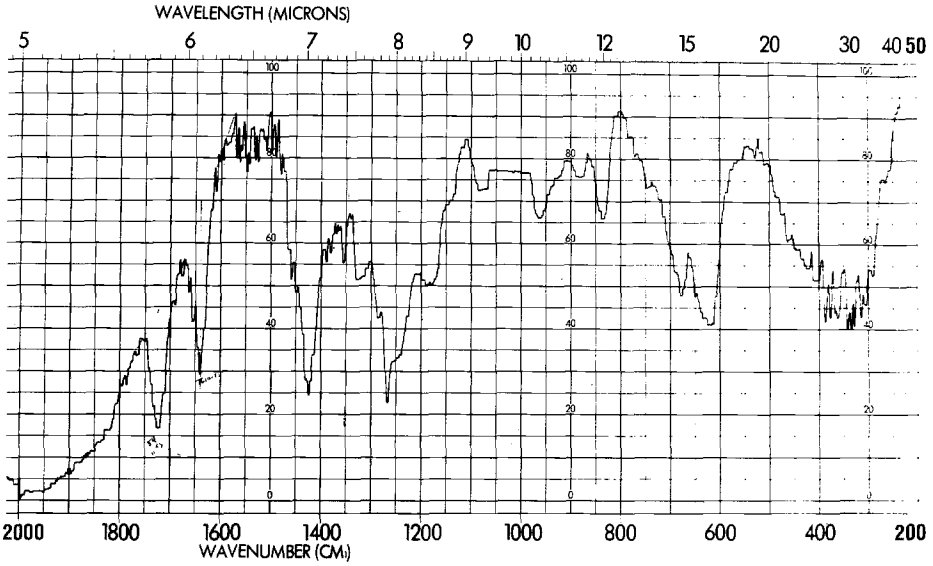

FIG. 2—*Insulation after heating for 2 h at 75 °C.*

had decreased significantly as compared to the initial spectrum. Further heating over a weekend eliminated these bands entirely and gave a spectrum equivalent to that for normal polyvinyl chloride (PVC) insulation material (Fig. 3).

To evaluate our hypothesis, samples of leg wire of the three major types were placed in large plastic vials which also contained 1 to 2 g of commercial dynamite. The samples were sealed and set aside for several days to allow contact between the wires and vapor from the dynamite. A similar situation could arise either during the storage of an improvised dynamite bomb or if dynamite and electric blasting caps were improperly stored together. A portion of each sample was subsequently examined by the diamond cell IR method and the spectra were compared with those of the same type of wire maintained as controls. Diamond cell IR spectra of leg wire insulation materials are included in Ref *1*. Of the three types of insulation material studied, high density polyethylene (HDPE), polyethylene/polypropylene copolymer (PPE), and PVC, only PVC showed the bands attributable to dynamite in the IR spectrum. This was also the type of insulation material involved in the actual case sample and indicates that EGDN and NG vapors are not strongly adsorbed onto HDPE or PPE but are readily adsorbed by PVC.

Prior to the use of the diamond cell technique, hot pressed films of the leg wire insulation had been used for IR examination and the presence of nitrate esters had not been observed. With the questioned sample for the case, however, weak nitrate ester bands were present in the hot pressed film IR spectrum. In the diamond cell technique, the sample is not heated but is placed between the faces of two diamonds and pressed at room temperature into a film. Any adsorbed EGDN or NG might therefore be detected in the IR examination. The detection of these two components in wire insulation is in-

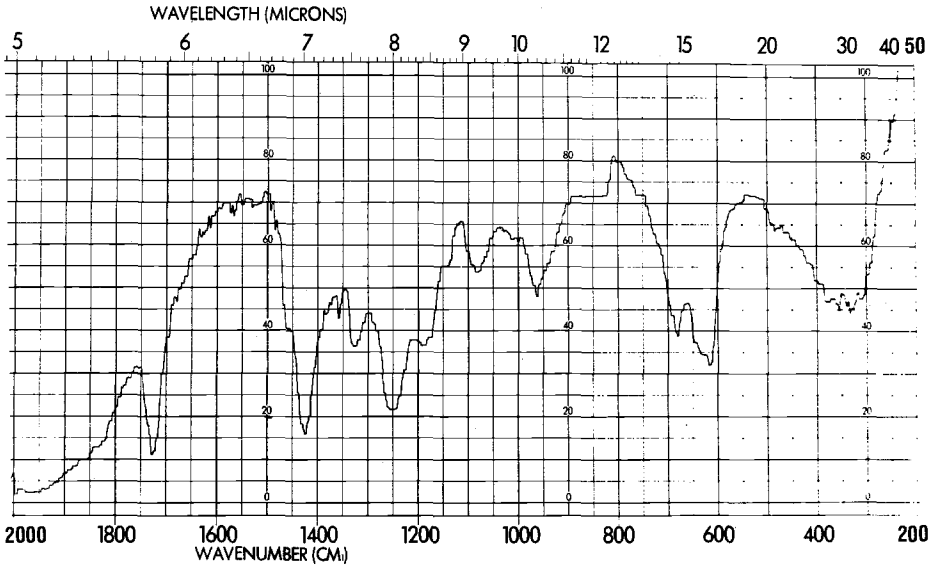

FIG. 3—*Insulation after heating for 72 h at 75°C.*

dicative of the use of commercial dynamite as the explosive and can be of considerable value in a situation where no explosive was identified in the blast debris. Caution should be exercised in drawing this conclusion, however, because prior storage of the blasting cap with dynamite could lead to contamination of the wire insulation which may still be present following its use with an explosive other than dynamite.

When extraneous bands are detected in the IR examination of suspected leg wire insulation, the analyst should recognize that their presence need not interfere with manufacturer identification. If the sample is heated for a relatively short time, the extraneous bands will be removed and the spectrum can then be compared effectively with known standards. Re-examination of the original IR spectrum may then prove useful for explosive identification as well.

Acknowledgment

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References

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[*2*] Midkiff, C. R., Jr. and Washington, W. D., "Systematic Approach to the Detection of Explosive Residues. III. Commercial Dynamites," *Journal of the Association of Official Analytical Chemists,* Vol. 57, No. 5, Sept. 1974, pp. 1092–1097.

[*3*] Washington, W. D. and Midkiff, C. R., Jr., "Systematic Approach to the Detection of Explosive Residues. II. Trace Vapor Analysis," *Journal of the Association of Official Analytical Chemists,* Vol. 56, No. 5, Sept. 1973, pp. 1239–1245.

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