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The Evidentiary Value of Plastic Bags

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With the advent and explosive popularity of disposable products within our society, the FBI Laboratory has recently received contributor requests to conduct forensic examinations of disposable blown film products, such as garbage bags. Through such examinations, it is hoped that these disposable bags, which are obtained as evidence primarily in homicide or drug cases, will be associated to a similar film product located in the possession of a suspect.

This article discusses how disposable blown film is produced and explains the variety of manufacturing characteristics, such as pigment bands, die lines or weld lines, fisheyes, and arrowheads, that may be found during examination of plastic bags. Finally, this article seeks to inform criminal investigators concerning the forensic value of blown film products when they are properly collected, preserved, and examined for unique manufacturing characteristics.

Preliminary Research

Pioneering research in the field was conducted by Ulf G. von Bremen and Lorne K. R. Blunt.[1] However, in order to further support their examinations and subsequent testimony, examiners from the FBI Laboratory determined that they needed more first-hand information than the initial research provided. Therefore, the examiners visited manufacturing plants to find out how these products are made.

The Manufacturing Process

Blown film is produced by converting resin pellets (polyethylene) to a melt, which is then forced by an extruder through a ring-shaped die to form a continuous tube of plastic. As the melt exits the extruder(s), it is forced through a screen at high pressure, which may accelerate debris and impurities through the screen to the die. The inflated tube is regulated for desired film gauge, collapsed by

frames, and pulled through nib and idler rolls.[2]

After this process, several other procedures impart class and potential unique individual characteristics to the completed bags. These include hot knife cutting and simultaneous sealing of bag edges, reinflation to ensure the plastic film does not adhere together, teflon heat seal of the skirt or bag hem, perforation, separation, and packaging.

In an ideal manufacturing environment, all possible film defects would be detected and eliminated.[3] But, in reality, a number of occurrences impart class and unique individual characteristics that enhance the forensic examination.

The Examination

The examination, physical comparison, and matching of polyethylene plastic bags are conducted visually with the aid of transmitted light and low power magnification. In addition, industry research has developed the use of a profilometer to measure caliper average, low point, high point, and profile of the polyethylene film. To record the examination, the specimens are affixed to a light table by double-sided light tack tape and photographed to document pertinent findings.

Preliminary examination and inter-comparison of questioned and known bags include the observation of such class characteristics as color, size, embossed code, and construction.[4] Construction characteristics are related to manufacturing and include the location of seams, length of hem (the portion of the bag past the bottom seam), and pigment bands.[5] These bands are caused by inadequate mixing of dyes and pigments with the melt and often run in the general direction of the film production.[6] In addition, die lines or weld lines frequently occur during construction as a result of a damaged die mandrel or from degraded particles of resin or dust lodged under or in the die lips.[7]

As previously mentioned, during the manufacturing process, extruders mix resin pellets and dyes, and the melt is forced through a screen pack at great pressure. Carbon material, resin, pigment or simple grit is formed on either side of the screen pack and is randomly injected into the molten air column. Consequently, the plastic stretches around the unwanted material to form a fisheye. Fisheyes vary in size from one to several centimeters in length and appear as dark spots with one or two lighter colored tails.[8]

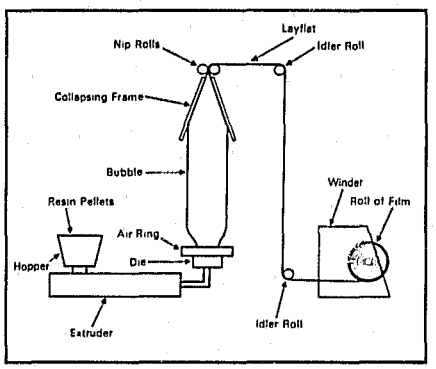
> ***"Because drug and homicide violations account for many of the crimes associated with polyethylene bags, special care is required to collect, preserve, and transmit these bags."***

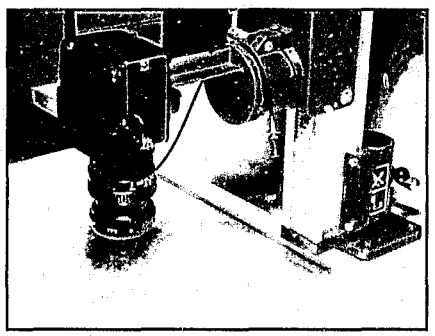
The introduction of unwanted contamination may also result in an individual characteristic known as an arrowhead. Arrowheads vary in length and size by several centimeters and manifest themselves as dark lines meeting at an apex and pointing away from the die mandrel during manufacturing.[9]

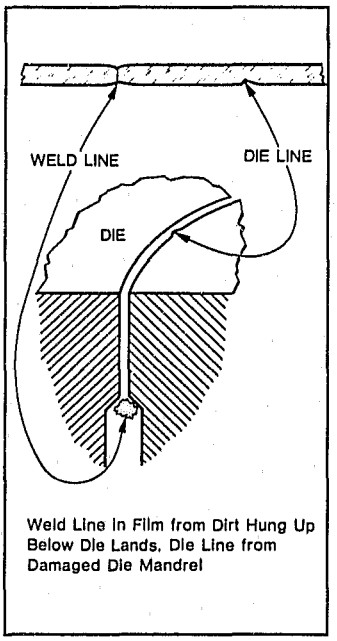
When the individual characteristics or imperfections, such as fisheyes and/or arrowheads, are recognized and compared, the examiner may be able to positively associate two bags as having originally been one piece of plastic. However, to make this conclusion, the random imperfections must be sufficient in quantity and must run across two consecutively produced bags.[10]

Another area of the manufacturing process that the FBI Laboratory has examined is the heat seal of the hem or bottom of the polyethylene bag. The heat seal is created as the sheet film is directed between two metal bars that are wrapped with teflon tape. Then, heat is applied, and the bag is sealed. The teflon tape prevents the melted plastic from adhering to the hot metal; however, it also randomly collects foreign particles and impurities that are then imprinted on consecutive bags. In addition, only the top teflon strip may be rotated to a clean section without stopping production. Examiners base their conclusions on the observation and comparison of the impurities collected on the teflon tape, the nicks and chips on the metal bars, and the resultant changing pattern that is imprinted on the hem.

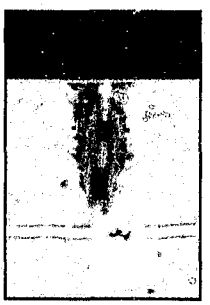
After proper examination of these characteristics, examiners may be able to state that two bags were sealed by the same teflon tape/metal bar in close proximity. The importance of this type of testimony is magnified when it is explained that the manufacturing line moves at an approximate rate of 200 feet per minute and that research and exami-

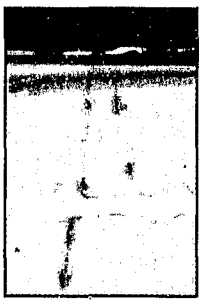






Weld Line in Film from Dirt Hung Up Below Die Lands, Die Line from Damaged Die Mandrel





1.) Basic blown film line
2.) Examination camera
3.) Cross section of film
4.) An example of a fisheye
5.) An example of an arrowhead

nation of consecutively produced bags has shown that over a roll of only 50 bags, the heat seal changes from the first bag to the last.

Collection, Preservation, and Transmittal

Because drug and homicide violations account for many of the crimes associated with polyethylene bags, special care is required to collect, preserve, and transmit these bags. During crime scene processing and subsequent searches of suspect locations conducted during these investigations, the investigator should collect bags of matching size and color that are distributed throughout a location to afford the examiner an opportunity to determine possible sequencing of the bags.

Additionally, investigators should not cut or rip the edges of the bag to remove the contents. However, if an incision must be made, it should be made in the center of the bag in order to preserve the opening and all edges, seams, and hems for examination of manufacturing characteristics. If the bag is stained, it should be thoroughly air dried away from direct sunlight before submission to the Laboratory. Also, all polyethylene bags should be packed in unused paper bags or wrapping paper and mailed to the Laboratory by registered mail or express mail.

Conclusion

The forensic examination of polyethylene bags for class and unique individual characteristics, when conducted by an examiner with a thorough understanding of the manufacturing process, can provide criminal investigators with an additional scientific means to resolve questions of a plastic bag obtained as evidence in criminal cases. This procedure enhances law enforcement's ability to investigate and develop prosecutable cases.✦

Endnotes

[1] Ulf G. von Bremen and Lorne K. R. Blunt, "Physical Comparison of Plastic Garbage Bags and Sandwich Bags," *Journal of Forensic Sciences*, vol. 28, No. 3, July 1983, pp. 647-648.
[2] USI Chemicals Company, *How to Solve Blown Film Problems*, p. 3.
[3] Ibid., p. 21.
[4] Supra note 1.
[5] Supra note 1, p. 648.
[6] Ibid.
[7] Supra note 2, p. 22.
[8] Supra note 1, p. 650.
[9] Supra note 1, pp. 651-652.
[10] Supra note 1, p. 654.

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