

FORENSIC EXAMINATION OF DUCT TAPE

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Twelve samples of duct tape were examined in an effort to determine the properties which may distinguish one duct tape sample from another. Methods employed in this study included examination of the weave pattern of the reinforcing cloth; determination of the number of threads per inch in the cloth; identification of the fibers in the threads; determination of the type of twist, if any, in the threads; visual examination of the adhesive; infrared (IR) analysis of the adhesive and tape backing; determination of the solubility of the tape backing; and elemental analysis of the adhesive by emission spectroscopy.

Most of the tape samples examined were distinguished by comparison of cloth weave patterns and by thread counts. Four general types of weave patterns were observed: rectangular, rectangular irregular cross threads, distorted rectangular and parallelogram. Thread counts varied widely from sample to sample. Tape samples not readily distinguished by these methods may be distinguished by other methods explored in this study.

Infrared analysis showed that all the tape adhesives studied were polypropylene-based. Carbonate and silicate were the principle additives. In each

sample the backing material, also examined by IR spectrometry, was found to be mainly polyethylene (PE). In most of the samples, the PE tape backing was soluble in hot toluene; in one sample (Tuck) the PE tape backing was insoluble in hot toluene.

The "Z" twist was the most common arrangement of the fibers in the threads. Braided threads were found in samples of two tape brands (Shur-tape and Manco). Measurement of the fibers' refractive indices showed that the threads in most of the samples were cotton-polyester blends; threads in other samples were cotton-rayon blends or pure polyester.

Analysis of the tapes' adhesives by emission spectroscopy showed the presence of aluminum, silicon, iron, titanium and magnesium in all the samples examined. Calcium and zinc were detected in most, but not all, of the samples. A summary of the experimental results is given in Table 1.

Although many tape samples may be distinguished by observation of cloth weave patterns and by thread counts, other methods of analysis, such as those listed above, may be useful in differentiating between physically similar samples or in demonstrating their physical and chemical consistency.

Table 1. SUMMARY OF EXPERIMENTAL RESULTS

	Brand	Weave Pattern ^a	Thread Count ^b		Adhesive Visual Exam ^c	HCl Test ^d	Adhesive Infrared ^e	Tape Backing Infrared ^f	Solubility of Backing in Toluene ^g	Fibers ^h	Thread Type ⁱ		Elemental Analysis of Adhesive ^j						
			LE	CR							LE	CR	Ca	Al	Si	Fe	Ti	Zn	Mg
1A.	Nashua	Rect. ICR	11	24	OW, R	Pos.	PP, C, LS	PE	Sol.	P, R	Z	Z	H	M	H	M	M	M	M
1B.	Pay-N-Pak	Rect. ICR	11	24	OW, R	Pos	PP, C, LS	PE	Sol.	P, R	Z	Z	H	M	H	M	M	M	M
2.	Shurtape	Rect.	15.5	19	OW, R	Neg.	PP, S	PE	Sol.	P	STB	ST	L	M	H	M	L	L	M
3.	Shurtape	Distorted Rect.	20	32	OW, R	Neg.	PP, S	PE	Sol.	P	Z	Z	L	M	H	M	M	L	M
4.	Montgomery-Wards	Rect.	32	19	OW, R	Neg.	PP, S	PE	Sol.	P, C	Z	Z	None	M	H	L	L	None	M
5AB.	Manco	Rect.	15.5	19	OW, R	Neg.	PP, S	PE	Sol.	P	STB	ST	L	M	H	M	M	L	M
6.	Tuck	Rect. ICR	21	26	W, R	Neg.	PP, S	PE	Sol.	P, C	Z	Z	L	M	H	L	M	M	M
7.	Tuck	Rect. ICR	21	26	W, R	Neg.	PP, S	PE	Insol.	P, C	Z	Z	L	M	H	M	M	M	M
8.	Frost King	Parallelogram	18	32	OW, R	Neg.	PP, S, CS?	PE	Sol.	P, C	Z	Z	L	M	H	M	M	H	M
9.	Anchor	Rect.	13.5	30.5	OW, R	Pos.	PP, C, LS	PE	Sol.	P, C	Z	Z	H	M	H	M	M	H	M
10.	Marcy	Rect.	19	31	OW, R	Neg.	PP, S	PE	Sol.	P, C	Z	Z	L	M	H	L	M	None	M

^aRect. = rectangular; ICR = irregular cross threads.

^bMeasured in threads per inch; LE = lengthwise; CR = crosswise.

^cOW = off-white; R = rubber particles in adhesive; W = white.

^dPos. = positive (evolution of gas); Neg. = negative.

^ePP = polypropylene; C = carbonate; LS = small amount of silicate; S = silicate; CS = carboxylate salt.

^fPE = polyethylene.

^gSolubility in toluene at 80° C; Sol. = soluble; Insol. = insoluble.

^hP = polyester; R = rayon; C = cotton.

ⁱZ = "Z" twist; STB = straight in braid; ST = straight.

^jH = relatively high concentration; M = medium; L = low.