FIBRE-PLASTIC FUSIONS IN TRAFFIC ACCIDENT RECONSTRUCTION

Georg JOCHEM[1], Herbert PABST[2]

[1] *Landeskriminalamt Sachsen, Kriminaltechnisches Institut, Dresden, Germany*

[2] *Bayerisches Landeskriminalamt, München, Germany*

ABSTRACT: Examination of fibre-plastic fusion – contact traces produced almost exclusively in traffic accidents – allows the determination of the seating arrangement of the occupants of the car at the moment of the impact and the trajectories of the occupants during the accident. One such case is described.

KEY WORDS: Fibres; Plastics; Traffic accidents; Microscopy.

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In several cases the unequivocal determination of the driver responsible for a car accident is predominantly the task of traffic accident investigators. The driver may attempt to evade responsibility for an accident by claiming that someone else was driving. Furthermore the seating arrangement may not be determinable through testimonial evidence as a result of death or serious injury of the occupants or because memories of the accident have been lost because of the violence of the event.

Therefore the investigators must look for traces that have been caused by the accident and the examination of which leads to clear statements in the testimony of the expert witness, e.g. hairs pinched in the cracked windscreen.

Fibre traces (or hairs) on the seats commonly collected with adhesive tape have only very low, if any, evidential value in these cases, because it is mostly impossible to determine the exact time of the transfer of such loose particles. The occupants may have changed places a short time before or after the accident or may have left or be pulled out the car by the rescue service through the same door. For the same and some additional reasons the interpretation of bloodstains in the car may also give rise to some problems, if no clear pattern resulting from an impact, e.g. of a head in the windscreen, can be recognised.

Fortunately, in traffic accidents other traces often occur, which have a higher evidential value than those mentioned above. In a collision, contact

traces may be exchanged between the interior surfaces made of thermoplastics and the clothing of the occupants.

According to the direction of an impact the occupants will be catapulted onto parts of the interior equipment of the vehicle. As a result, pieces of garments are frequently rubbed under high pressure against surfaces of thermoplastic components and the kinetic energy of the bodies is transformed into frictional heat which causes local melting of the thermoplastic material.

During these contacts, which will last only a split second, textile fibres of the rubbing garment are transferred into the softened plastic and are fixed in the immediately re-solidifying material. By comparison with the clothing of all occupants the transferred fibres can be assigned to a distinct garment. Therefore these fibre-plastic fusions (FPFs) are a kind of snapshot, showing the examiner which garment was in which place at the very moment of the impact.

In addition FPFs in most cases show threads of smeared plastic which indicate the direction of the impact that produced them. Hence the outcome of a fibre-plastic fusion examination may not only be the seating arrangement of the occupants of an automobile in the moment of the impact, FPFs may also help to determine the trajectories of the vehicle's occupants during the accident. In some more complicated cases, e.g. if a car overturns and persons are ejected from the car, it might be necessary to consult a technical expert who is able to analyse the movements of the occupants or to simulate them by means of a computer program like "PC-Crash", respectively.

The corresponding trace to the FPFs on the interior plastic surfaces in a car are plastic coating marks on the clothing (garments, shoes) of the occupants. These traces are formed somewhat less frequently – usually in high-speed impacts – by transfer of softened thermoplastic material from the interior of the car to the clothing. They are rather valuable particularly if garments showing a low sheddability are involved (e.g. leather, filament yarn fabric) or if two occupants of a car are wearing garments made of indistinguishable fibres (e.g. blue jeans, white cotton shirts).

To examine the transferred plastic materials they are isolated from the textiles, then heated and pressed to thin films (< 10 µm) under a small press which was especially constructed by H. Pabst for that purpose. Even very small amounts down to some nanogramms of the plastic material will be sufficient for an examination and are manageable with a steady hand.

The obtained polymer films are examined using FTIR spectroscopy and microscopic methods such as transmitted light, darkfield and polarised light. Under the microscope the samples reveal an impressive variety concerning their colour and their filler components. The use of these quite simple techniques to investigate plastic material therefore leads to a signifi-

cantly higher discrimination power compared to the sole use of FTIR spectroscopy.

Finally it has to be stressed that the fibre-plastic fusions and plastic coating marks have a very high evidential value, since in the "closed system" of a car only:

- a limited number of occupants with
- a limited number of items of clothing will have contact with
- a limited number of different interior components made of thermoplastic material.

This fact enables us in most cases to come to uneqivocal assignments and clear statements just by the analysis of the interaction of mass products like fibres and plastics – without the use of DNA or fingerprints. For example, during the last 20 years at the BLKA (Bayrisches Landeskriminalamt) the examination of car and motorcycle accidents using the methods described above led to unequivocal expertises in about 75 per cent of more than 2500 cases.

Case description. This case involves an imported car occupied by three young male persons. While driving on a narrow road at a speed of approximately 120 km per hour the driver lost control of the vehicle in a right-hand bend and the car collided with a tree on the right side of the road. The point of impact was on the left side of the vehicle, immediately in front of the A pillar. The car broke up in two parts along a line between the two A pillars. The front part including the motor moved to the left side of the street while the remaining part with the occupants rotated around the tree and overturned. Two persons were ejected from the vehicle, one of them was found dead and the other one seriously injured just beside the wreck. The driver's seat and the steering wheel were also ejected. The third occupant was found lying dead on the back seat.

Examination of the wreck and the clothing of the involved persons revealed several fibre plastic fusions:

- On the cover of the steering column we found a fusing mark with embedded dark grey cotton fibres. These fibres only matched those in the trousers of person A. Examination of that trousers revealed transferred plastic material in the area of the right knee matching the polypropylene cover of the steering column.
- The plastic caps of the clutch and the break pedal showed some melting marks. Corresponding to these we found plastic coating marks on the sole of the right shoe of person A. The transferred material on the sole matched the polyvinylchloride material of the pedals.
- On the brake handle, the middle of the dashboard and the hinged lid of the glove compartment we found fusing marks with embedded colourless and blue cotton fibres only matching the fibres in the blue jeans of

person B. In the area of the left knee of these jeans a lot of transferred plastic material was observed, but we didn't examine this in detail.

– On the inside panelling of the right front door a fusing mark including a large number of dark blue cotton fibres was observed. These fibres only matched those in the socks of person B.
– On the interior light and on the back rest of the front passenger's seat we found fusing marks including light blue cotton fibres. These fibres only matched those in the T-shirt of person B. Corresponding to the fusing mark on the back rest we found a plastic coating mark on the back of the T-shirt of person B. The transferred material matched the molten polyester fibres of the seat cover.

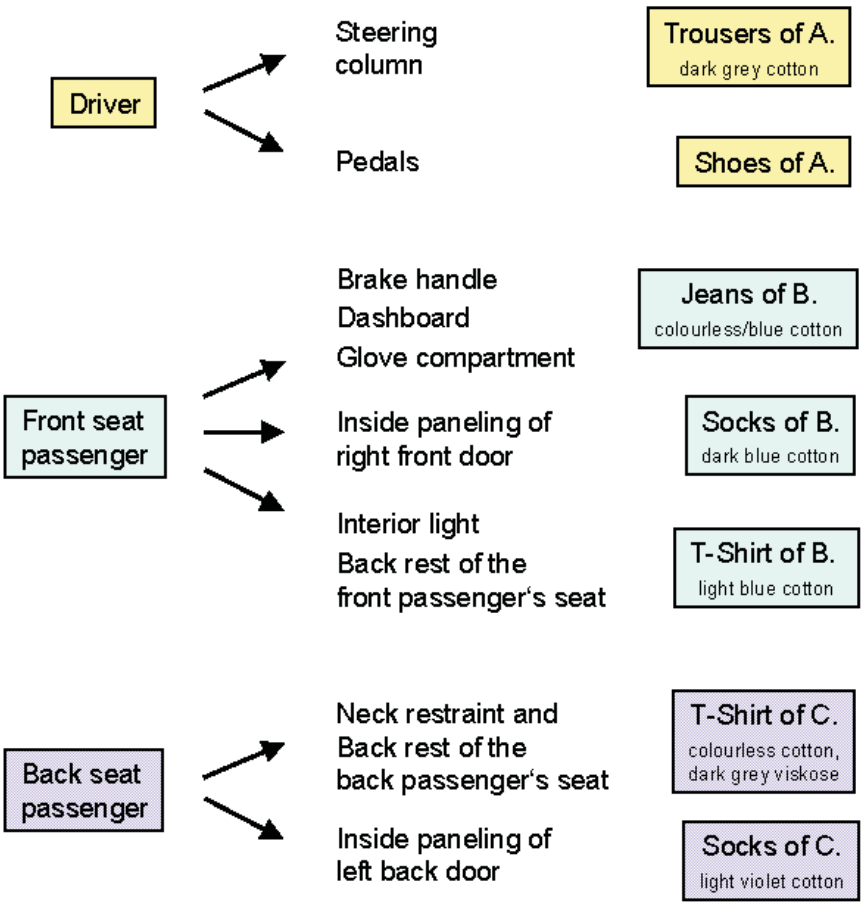

Fig. 1. Assignment of the fibre plastic fusions to seating positions and textiles.

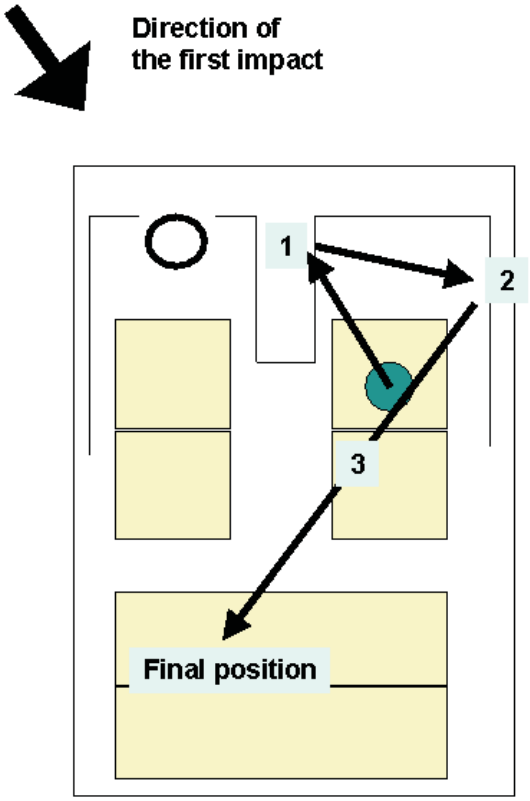

Fig. 2. Movement of the front seat passenger during the accident.

– On the upper part of the inside cover of the left back door a fusing mark including a large number of light violet cotton fibres was observed. These fibres only matched those in the socks of person C.
– On the left neck restraint and just below that on the back rest of the back passenger's seat we found fusing marks including colourless cotton fibres and dark grey viscose fibres. These fibres only matched those in the T-shirt of person C.

Figure 1 shows the resulting assignment of the fibre plastic fusions to the sitting positions and the textiles worn by the occupants. According to these results it was obvious that person A was the driver of the car and person B and C were the front passenger and the back seat passenger, respectively.

But at the scene Person B was found lying dead on the back seat and person C lay beside the wreck. A mix-up of the clothing of B and C was clearly

ruled out, therefore we had to think about the possible movements of the front seat passenger during the accident.

According to the examination none of the occupants was wearing his seat belt. On reconstruction of the accident therefore a technical expert came to the conclusion that the front seat passenger may have indeed been thrown from his seat into the back of the car. This course is documented by the direction of the FPF's: In position 1 (middle of the dashboard, brake handle, glove compartment and interior light) the fibre plastic fusion marks run from the back to the front, whereas in position 2 and 3 the FPF's indicate a movement of the textiles from the front to the back (Figure 2). In accordance with these findings person B was catapulted against the middle of the dashboard (1) upon the first impact, hitting also the brake handle, the glove compartment and the interior light. While the car was spinning and overturning his feet hit the inside panelling of the right front door (2) and later on he was thrown over the back rest of his seat (3) into his final position in the back of the car.

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