A147 Test Burns Using Clumps of Hair

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After attending this presentation, attendees will have learned about the effects of heat on masses of hair and the effects of surrounding materials on the microscopic appearance of the hair.

This presentation will impact the forensic science community by showing how the condition of hair at fire scenes is affected by surrounding materials and by stimulating work in this area. Interpretation of their microscopic appearance requires an understanding of the context in which hairs were burned. Coatings on hairs burned with different fabrics vary with the fabrics and the heating conditions.

In a study in which cotton T-shirts and blue jeans were set on fire and burned, clippings from the floor of a hair salon were wrapped in pieces of cotton knit paint rags and rayon fabric scraps and placed on an outdoor grill with burning blue jeans. At a later time, more hair clippings were rolled in T-shirt fabric, placed into a coffee can, set on fire, and allowed to smolder. In both cases, the appearance of the burned hairs was unexpected. Unlike individual burned hairs or smaller groups of burned hair, the wrapped hairs fused into a shiny carbonaceous network resembling a beaded bag in one case and a delicate network of fused fibers or threads in the other case. How much of the appearance could be attributed to the fabrics used to wrap the hairs and how much could be attributed to the behavior of the hairs themselves? What would happen if the hair were burned while still on a person or animal? What is the range of expected appearance and the variables that affect it?

Follow-up experiments were conducted with clumps of hair clippings and combings using the following steps: (1) placed into glass jars then heated on a gas stove; (2) placed into metal cans and heated on a gas stove; (3) placed in glass jars and metal cans together with a piece of paper lit with a match; (4) wrapped in cotton knit, cotton-polyester knit, rayon, cotton denim, thin nylon knit, silk, and polyester blouse fabric, all commonly encountered clothing fabrics; (5) placed into glass jars and metal cans then heated on an unlit grill; (6) wrapped in nylon knit and a thin cotton sock, placed in metal cans, and heated on a gas stove; (7) placed directly into a metal can and heated on a gas stove; (8) placed in a metal can and clumps of hair placed in a cotton sock, with the cotton sock and another sock wrapped around the can. The assembly was placed in a glass jar. The socks were ignited then allowed to smolder for several hours; (9) wrapped around a piece of pork then heated in a metal pan placed on a grill; and, (10) the resulting burned materials were examined using a stereomicroscope.

Portions of all the hairs exhibited swelling with a whitish appearance at low magnification; most are reddened and some are charred. The hairs that were heated in metal cans, whether wrapped or not, exhibited charring and melting. Hairs that were wrapped in silk were partly coated with melt and decomposition from the silk. Stove-heated hairs wrapped in polyester and nylon were initially protected while the fabric melted. When the gas flame was increased, raising the temperature, the hairs melted and charred, as did those on the grill.

Hairs wrapped in cotton charred and turned brittle when heated in cans on the stove, but when the cotton was ignited and allowed to smolder, exhibited the carbonaceous network and beaded appearance that was first remarked upon. The cotton itself, where distant from the hairs, exhibited black microspheres typical of cellulose fiber pyrolysis, but not as plentiful as those on the hairs. A sticky amber residue was observed on the sides of the burn jar. It is not yet known whether the tiny beads on the hair and the shiny coating are from the hairs themselves, from a pyrolysis product of cotton, or a combination. This question will be resolved with further testing.

Thermal Damage, Forensic Hair Exam, Fire Debris

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