

Supplemental Materials

Fiberglass and other Flame-resistant Fibers in Mattress Covers

Jeff Wagner, Jefferson Fowles, and Tracy Barreau

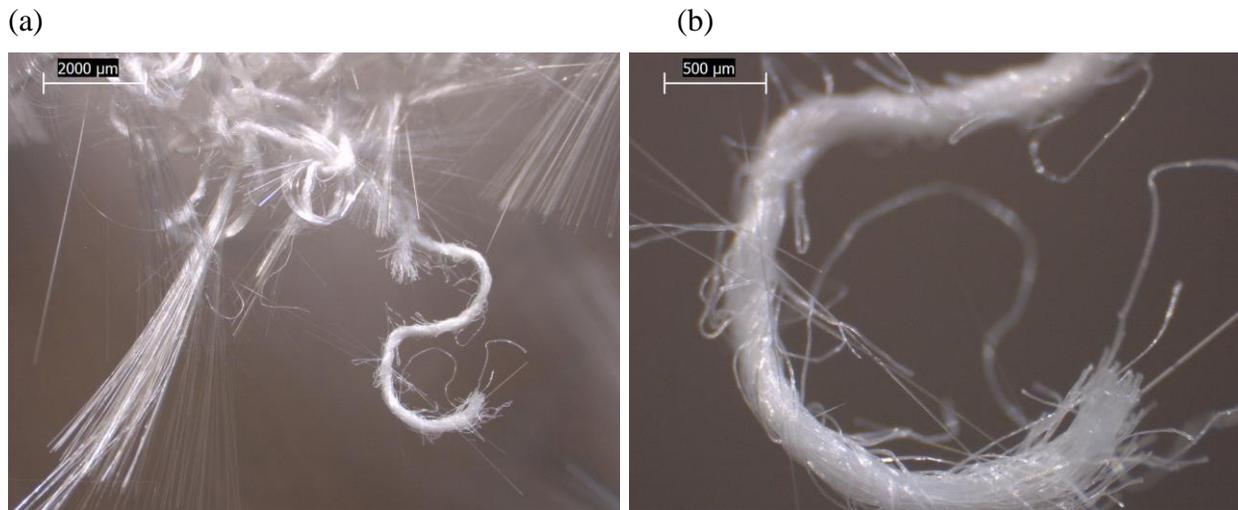


Figure S1. Additional 10x-80x images of FG-4 inner sock using low-power reflected light stereozoom microscope. a) straight fiberglass bundles and wavy synthetic fiber threads. b) higher magnification image of fibers in (a).

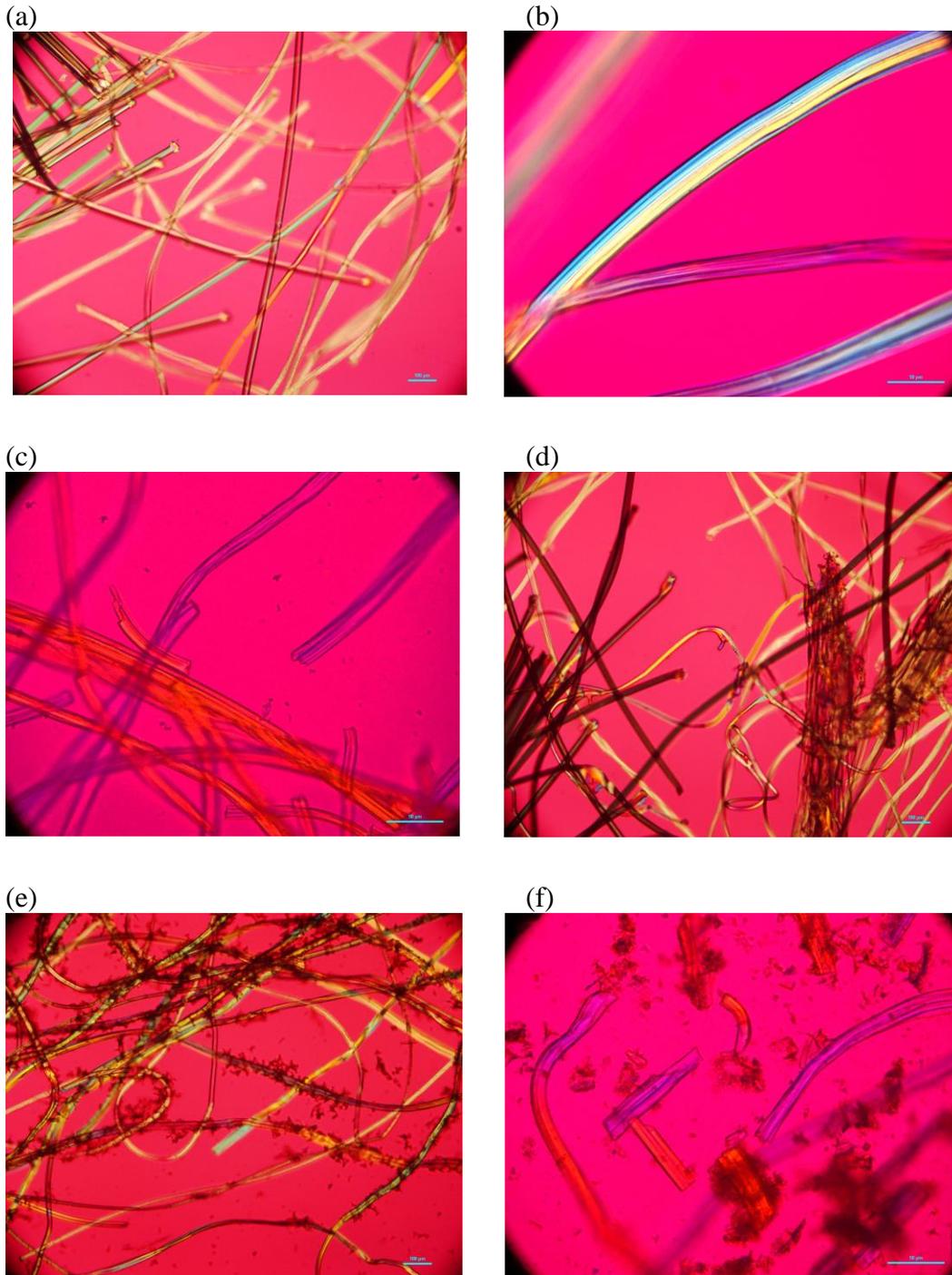


Figure S2. PLM images of FG-1. a) outer cover from top side of mattress showing mixture of birefringent synthetic fibers (100x). b) fibrous mat below top cover (400x). c) same sample as (b) after ashing at 485 C (400x). d) outer cover from mattress side showing mixture of birefringent synthetic fibers (100x). e) outer cover from mattress bottom showing mixture of birefringent synthetic fibers and coating (100x). f) same sample as (e) after ashing at 485 C (400x). The scale bars are 100 μm long (100x) and 50 μm long (400x).

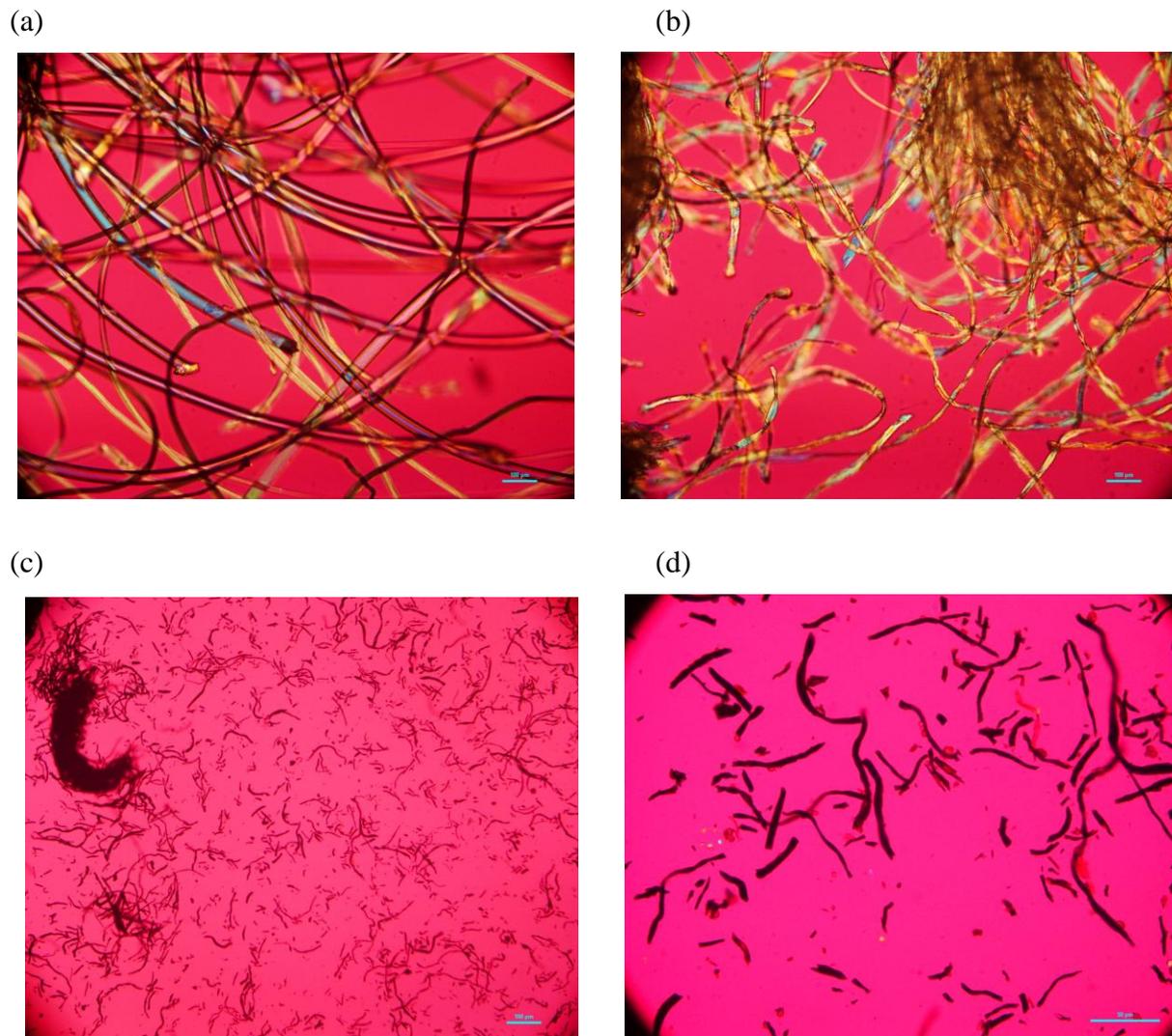


Figure S3. PLM images of FG-2. a) outer top cover material showing mixture of birefringent synthetic fibers (100x). b) inner cover material showing mixture of birefringent cellulosic fibers (100x). c) same sample as (b) after ashing at 485 C, showing charred fiber remnants (100x). d) same as (c) at 400x. The scale bars are 100 μm long (100x) and 50 μm long (400x).

(a)



(b)

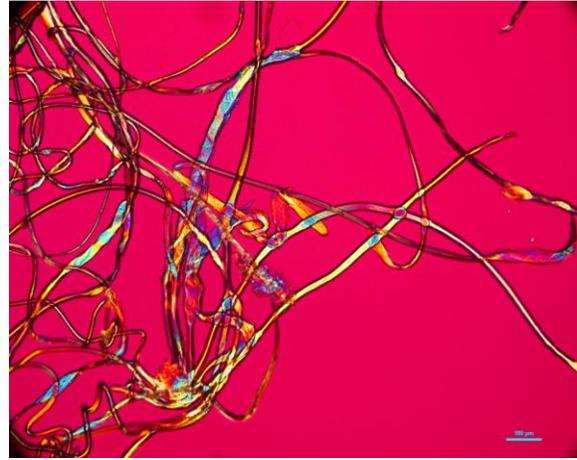
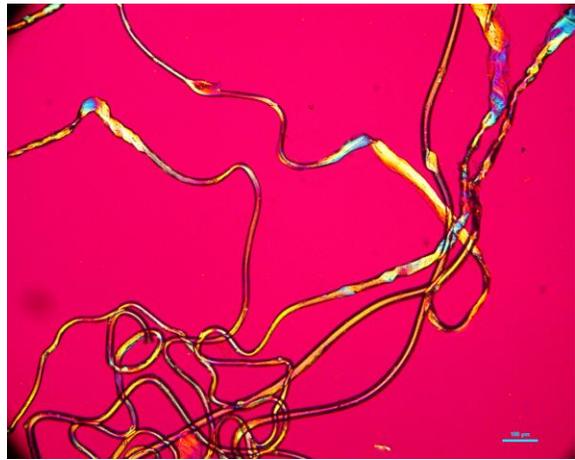


Figure S4. 100x PLM images of FG-3. a) outer cover material from top side of mattress showing homogeneous, birefringent synthetic fibers. b) outer cover material from bottom side of mattress showing a heterogeneous mixture of birefringent synthetic fibers. The scale bars are 100 μm long.

(a)



(b)

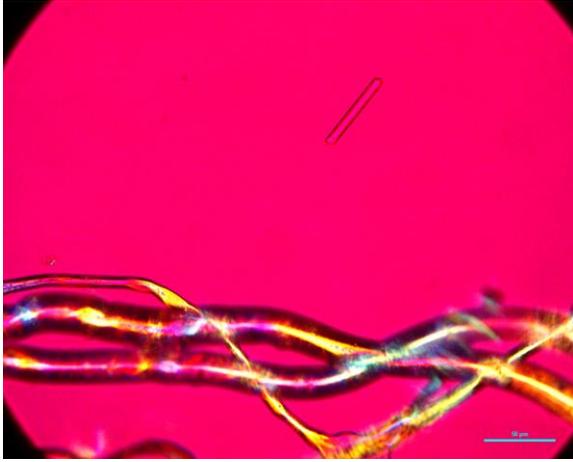


(c)

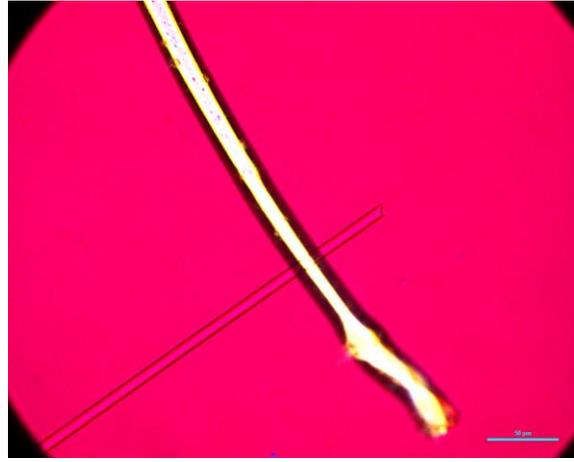


Figure S5. 100x PLM images of FG-4. a) outer cover material showing homogeneous, birefringent synthetic fibers and semi-opaque plastic film. b) inner cover material showing a heterogeneous mixture of birefringent synthetic fibers. c) inner sock material, showing straight, isotropic fiberglass fibers with blunt terminations. The scale bars are 100 μm long.

(a)



(b)



(c)

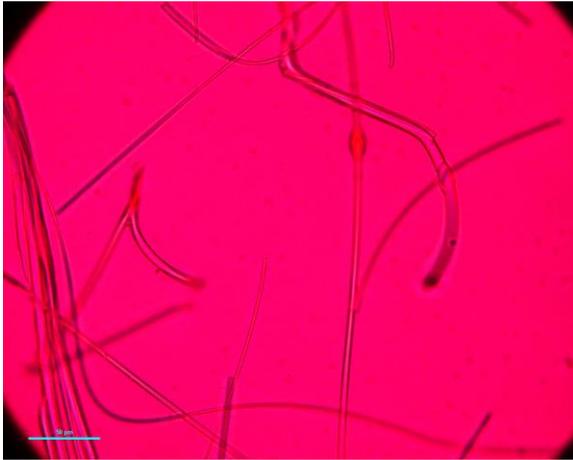
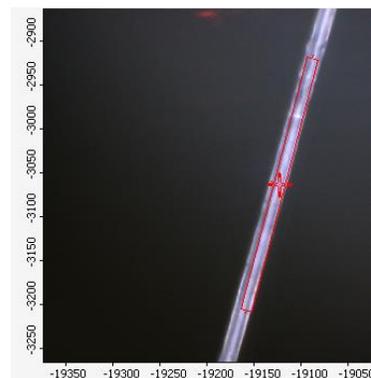
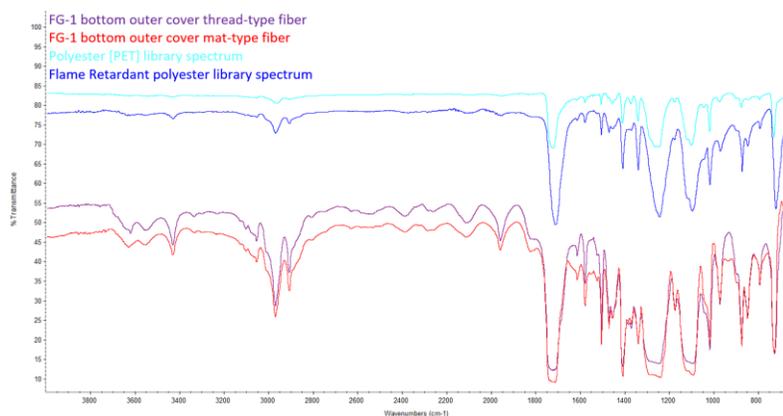
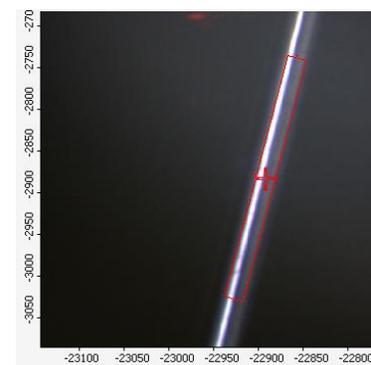
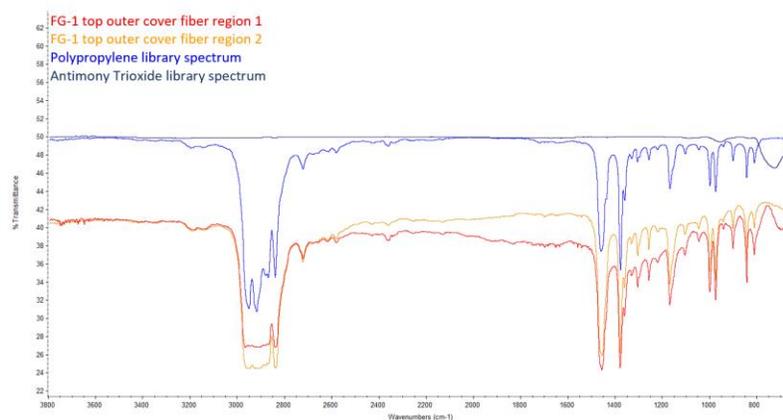


Figure S6. 400x PLM images of fiberglass morphology from a) FG-3 outer cover from bottom side b) FG-4 inner cover c) NIST fiberglass SRM. The scale bars are 50 μm long.

(a)



(b)



(c)

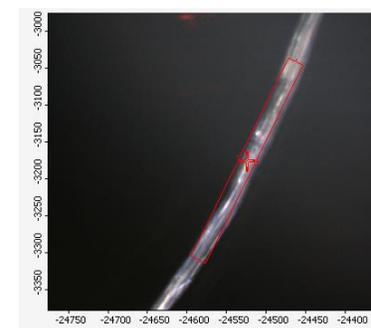
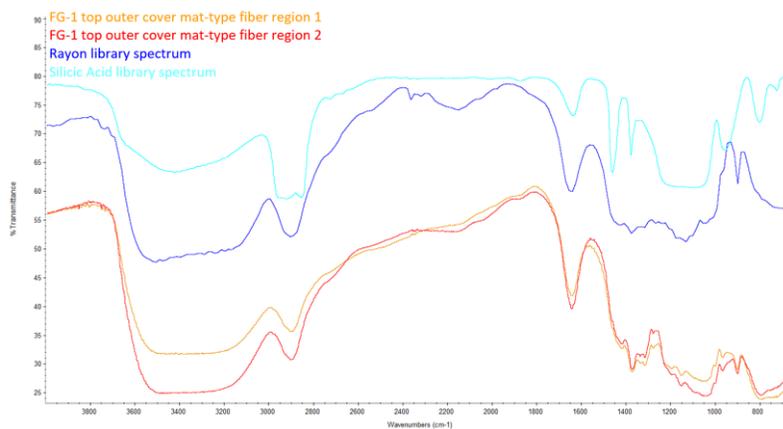


Figure S7. FTIR from three types of FG-1 fibers (red, orange, and purple spectra) and spectral library matches (blue and light blue): a) Flame retardant polyester and unmodified polyester. b) Polypropylene and antimony trioxide. c) Viscose (Rayon) and silicic acid.

Table S1. Mattress labels, certifications, and cover fibers identified.

| ID | Mattress | Components listed on flammability label | Chemical certifications and labels | Other labeled components | Cover fibers identified in this work |
|-----|---|---|------------------------------------|--|---|
| FG1 | Sealy Essentials Joyfulness 8.5" Firm Mattress - Twin | polyurethane foam, Rayon, polyester | CertiPur-US* | | Polyester, polypropylene, and Rayon (possible antimony trioxide and silicic acid) |
| FG2 | Modway Aveline 6" Twin | polyurethane foam, viscoelastic polyurethane foam | CertiPur-US | Outer cover top panel: polyester Outer cover bottom: polyester, cotton Inner cover: cotton | Synthetic and cellulosic (PLM only) |
| FG3 | Zinus Green Tea 6" memory foam | polyurethane foam, viscoelastic polyurethane foam | CertiPur-US* | Outer cover top/border: polyester Outer cover bottom: polypropylene Inner cover: fiberglass, acrylic | Fiberglass, flame retardant modacrylic/antimony trioxide, and polyester |
| FG4 | Graco crib & toddler deluxe mattress | polyurethane foam | CertiPur-US*, SB 1019 tag** | Fiber content: polyester | Fiberglass and flame retardant modacrylic/antimony trioxide |

* advertised online but not on product tag

** label specified by California flame retardant laws (BHGS, 2019) with box checked next to the line, "THE UPHOLSTERY MATERIALS IN THIS PRODUCT CONTAIN NO ADDED FLAME RETARDANT CHEMICALS."

Table S2. Summary of compositions determined from mattress cover analyses.

| Mattress | Cover component | Composition (% by mass) | | | | |
|-------------|-----------------------|-------------------------|-------------------|------------------|-----------------------|-------------------|
| | | Fiberglass | Cellulosic fibers | Synthetic fibers | Adhesives/ Binders | Other non-fibrous |
| FG1 Sealy | Top outer cover + mat | | | 80 | 20 | |
| | Side outer cover | | | 85 | 15 | |
| | Bottom outer cover | | | 80 | 20 | |
| FG2 Modway | Top outer cover | | | 100 | | |
| | Side outer cover | | | 100 | | |
| | Inner cover | | 100 | | | |
| | Bottom outer cover | | 5 | 95 | | |
| FG3 Zinus | Top/side outer cover | | | 99 | | 1 |
| | Inner sock | 50 | | 49 | | 1 |
| | Bottom outer cover | <1 | | 75 | 25 | |
| FG4 Graco | Outer cover | | | 85 | 15 | |
| | Inner cover | 1 | | 69 | 30 | |
| | Inner sock | 75 | | 24 | | 1 |
| Blank | EHLB Ref. #281 | | | 5 | | 95 |
| Ref. sample | NIST 1866a | 100 | | | | |