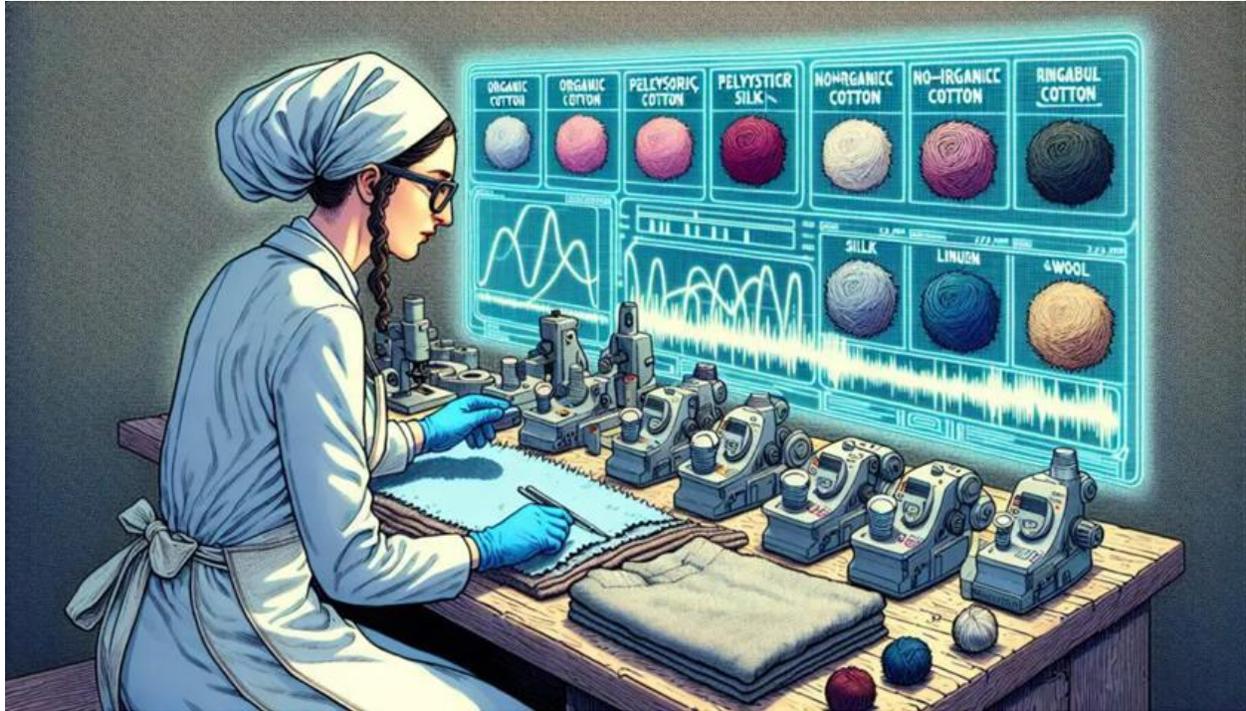


Fabrics, Frequency & Static Electricity



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Overview

Natural fibers like linen do not naturally have a fixed positive or negative charge. Instead, their electrical charge depends on various factors, especially when they interact with other materials through the [triboelectric](#) effect (static electricity).

- When two different materials rub against each other, electrons can transfer from one material to the other.
- The material that loses electrons becomes positively charged.
- The material that gains electrons becomes negatively charged.

The fabrics most susceptible to static electricity, ranked from lowest to highest.t.

1. Wool & Cashmere
2. Nylon
3. Cotton & Linen
4. Silk
5. Polyester
6. Acrylic
7. Spandex

Referenced studies confirm that synthetic fibers such as polyester, spandex, and acrylic generate significant static electricity with human skin because of their negative charge affinity, while natural fibers like wool, cashmere, and cotton produce less static. (See the *Charge Affinity* table on page 3, and *Sources* on page 6.)

Additionally, the studies indicate that fabrics with high [triboelectric](#) output (e.g., polyester) can cause discomfort due to static discharge, while low-output fabrics (e.g., linen and cotton) are more comfortable, affecting wearer comfort. Wool and cashmere, although not tested directly, are suggested to have low static because of their positive charge affinity.

- The magnitude of the charge generated depends on various factors, including the pressure and speed of rubbing, the surface roughness of the materials, and the humidity in the environment.
- High humidity can decrease the buildup of static electricity as moisture allows the charges to dissipate more easily.

Choose cotton, linen, wool, or cashmere for low static and comfort against the skin. Avoid polyester, spandex, and acrylic if you have sensitive skin or are in static-prone environments.

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Summary Tables

Charge Affinity

Material	Approximate Charge Affinity	Triboelectric Tendency
Wool & Cashmere	Strongly positive	Loses electrons
Nylon	Moderately/strongly positive	Loses electrons
Cotton & Linen	Neutral to slightly positive	Neutral, context-dependent
Silk	Slightly negative	Gains electrons
Polyester	Moderately negative	Gains electrons
Acrylic	Strongly negative	Gains electrons
Spandex	Moderately/strongly negative	Gains electrons

Interactions with Human Skin

Material	Charge Relative to Skin	Static Buildup with Skin	Practical Effect
Wool & Cashmere	Slightly positive	Very low	Minimal cling or shocks
Nylon	Slightly negative	Low to moderate	Mild cling, occasional small shocks
Cotton & Linen	Slightly negative	Low	Minimal cling, rarely noticeable
Silk	Moderately negative	Moderate	Noticeable cling, occasional shocks
Polyester	Strongly negative	High	Strong cling, frequent shocks
Spandex	Strongly negative	High	Strong cling, frequent shocks
Acrylic	Very strongly negative	Very high	Significant cling, frequent shocks

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Fabric Comparison Table

Fabric [5]	Ranking Relative to Human Skin	Clothing Comfort and Triboelectricity [1][2]	Health and Toxicity Considerations [3]	Interactions with Human Skin
Wool & Cashmere	Strongly positive, minimal charge transfer with skin (low static)		Natural Fibers [4]	Minimal static due to similar charge affinity to skin (keratin-based). Comfortable, low risk of shocks or cling.
Silk	Positive, especially when modified (e.g., with amino groups), moderate static with skin.	Lower COF and higher triboelectric output when modified, indicating strong positive charging against skin, leading to moderate static cling.	Natural Fibers [4]	Moderate static, especially with modified silk, which increases positive charging. May cause cling in dry conditions but is breathable and skin-friendly.
Nylon	Slightly positive to neutral, mild static with skin.	Moderate COF and triboelectric output, slightly negative relative to skin, causing mild static buildup.		Mild static, slightly negative relative to skin, leading to occasional cling or small shocks, particularly in tight clothing.
Cotton & Linen	Neutral to slightly negative, very low static with skin.	Low triboelectric output, indicating minimal charge transfer with skin, enhancing comfort.	Natural Fibers [4]	Very low static, comfortable against skin, minimal cling or shocks. Ideal for sensitive skin due to breathability.
Spandex	Strongly negative, high static with skin.		Prolonged contact with spandex can lead to contact dermatitis due to its inability to absorb sweat, which traps chemicals (e.g., dyes, formaldehyde) against skin. This exacerbates static-related discomfort, as spandex's negative charge affinity increases electron transfer from skin, potentially worsening irritation.	High static due to strong negative charge, leading to cling and potential shocks. Poor sweat absorption increases irritation risk.
Polyester	Very strongly negative, high static with skin.	High triboelectric output and COF, confirming strong negative charging against skin, leading to significant static cling and discomfort.	High static generation with skin, combined with poor sweat absorption, can lead to skin irritation and discomfort, especially in humid conditions.	High static, strong negative charge causes significant cling and shocks. Poor breathability exacerbates discomfort.
Acrylic	Extremely negative, highest static with skin.		Similarly, acrylic's strong negative charge affinity contributes to static cling, and its poor breathability traps sweat, increasing the risk of bacterial infections or folliculitis.	Highest static, very strong negative charge results in frequent shocks and cling. Poor breathability increases skin irritation risk.

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Notes

[1] Referenced studies developed an in-situ testing system coupling a reciprocating tribometer with [triboelectric](#) instruments to measure friction and charge generation. Fabrics were tested for their coefficient of friction (COF) and triboelectric output, which correlate strongly with static charge generation.

[2] Referenced studies suggest that fabrics with high [triboelectric](#) output (e.g., polyester) cause discomfort due to static discharge, while low-output fabrics (e.g., linen, cotton) are more comfortable. Wool and cashmere, though not tested directly, are implied to have low static due to their positive charge affinity.

[3] Referenced studies on synthetic fiber toxicity and textile contact dermatitis highlight health implications of [triboelectric](#) interactions with skin. Synthetic fibers' triboelectric properties (negative charging) amplify static-related discomfort and health risks compared to natural fibers.

[4] Natural Fibers (Cotton, Linen, Silk, Wool, Cashmere), particularly cotton and linen, have lower static generation and better breathability, reducing skin irritation. Wool and cashmere, being tribo-positive, minimize static with skin, making them skin-friendly.

[5] Low humidity increases static charge for all materials, particularly synthetics. Studies note higher [triboelectric](#) outputs at lower humidity, amplifying skin interactions.

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Sources

Bairagi, Satyaranjan, Gaurav Khandelwal, Xenofon Karagiorgis, Shravan Gokhool, Charchit Kumar, Guanbo Min, and Daniel M. Mulvihill. 2022. *ACS Applied Materials & Interfaces* 14 (39): 44591–603. doi:10.1021/acsami.2c13092.

Douillard, Dr. John. 2024. “The Dangers of Synthetic Clothing.” *John Douillard’s LifeSpa*. July 2. <https://lifspa.com/ayurvedic-lifestyle/synthetic-clothing/>.

Espinal, Jannely. 2021. “Have Sensitive Skin? Experts Recommend Shopping for These Clothing Materials.” *TODAY.com*. December 13. <https://www.today.com/shop/best-fabrics-fibers-sensitive-skin-t242078>.

Feng, Min. et al. “Clothing Comfort Sensing System Based on Triboelectric and Tribological Behavior of Fabrics.” *Nano Energy*. 2024. *Science Direct*. Elsevier. Volume 127, August, 109721. <https://www.sciencedirect.com/science/article/abs/pii/S2211285524004695>.

Li, Li. “Triboelectric series of different common fibers.” 2025. *ResearchGate*. Accessed August 8. https://www.researchgate.net/figure/Triboelectric-series-of-different-common-fibers_fig2_275245833.

Ngan, Vanessa. “Textile Contact Dermatitis.” 2024. *DermNet®*. June 10. <https://dermnetnz.org/topics/textile-contact-dermatitis>.

Singh, Zorawar. “Toxicity of Synthetic Fibres and Human Health (OPEN ACCESS)” 2017. January. https://www.researchgate.net/publication/316044390_Toxicity_of_Synthetic_Fibres_and_Human_Health_OPEN_ACCESS.

Tina. 2025. “Fabric Static Electricity: The Complete Guide to Prevention!” *ChiuVention*. <https://chiuvention.com/blog/fabric-static-electricity-the-complete-guide-to-prevention>.