Acrylic Fibre: What Acrylic Is, Its Properties and How It Is Made

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In one paragraph

Acrylic is a synthetic fibre made from polyacrylonitrile: by law, at least 85% of the polymer is acrylonitrile (Regulation (EU) No 1007/2011, Annex I; 16 CFR 303.7). It is sold as the cheaper alternative to wool, “a common substitute for wool in clothing and home furnishings” in Britannica’s words, because it can be made soft, bulky and warm. It is light, dries fast, takes bright colours and resists sunlight, which is why it is used for knitwear, blankets, faux fur and outdoor awnings. Against that, it takes up little moisture, it pills, it is flammable, and in one study it shed the most microfibres per wash of the fabrics tested. It is a small fibre: just under 1.6 million tonnes in 2024, 1.2% of the world’s fibre, and declining (Textile Exchange).

At a glance

Pros and cons of acrylic

Advantages	Drawbacks
Soft, light and bulky: wool-like warmth for less money	Holds only 1.5–2% moisture, so it feels clammy in warmth
Dries fast and keeps its shape after washing	Pills: the fibres work to the surface and ball up
Strong resistance to sunlight and weather, so it suits awnings and outdoor cushions	Flammable, with a limiting oxygen index of 18, and softens around 220–240 °C
Not eaten by moths and resists mildew	Had the highest microfibre release per wash of the fabrics in the Plymouth study
Takes bright colours with basic dyes	Made from acrylonitrile, now an IARC Group 1 carcinogen in occupational exposure

Properties of acrylic fibre

Property	Value	Source
Density	1.16–1.18 g/cm³ (Vardhman: 1.17)	CAMEO; Rosa and colleagues (2024); Vardhman
Tenacity	2.5–5.0 g/den dry, 2.0–4.5 wet (Vardhman); 2 to 4 g/den, 18 to 36 g/tex, dry, falling to 13 to 27 g/tex wet (review)	Vardhman; Rosa and colleagues
Elongation at break	25–50% dry, 25–60% wet	Vardhman
Moisture regain	1.5–2.0% commercial; EU allowance 2.00%	Vardhman; Regulation 1007/2011
Glass transition	70–80 °C in water; 95–105 °C dry	Vardhman
Melting	“no definite melting point… decomposes before melting”; softens at about 220–240 °C	Vardhman
Limiting oxygen index	18	Rosa and colleagues
Sunlight	“high resistance to weathering and to sunlight”	Vardhman

Property	Value	Source
Solvents	Dissolves in DMF, DMSO, DMAc and saturated zinc chloride	Vardhman; EU Annex VIII, method 8

Key figures and their sources

- High-bulk yarns mix shrinkable and already-shrunk fibres; when the yarn is steamed or dyed, “the yarn ‘bulks up’ through shrinkage of the shrinkable staple fibre and acquires a bulky, wool-like feel”, with 40 to 45% shrinkable fibre in a typical high-bulk yarn (Bayer patent).
  Source: Bayer patent (patents.google.com)
- GINETEX, which administers the care symbols, says “Acrylic clothes can be washed at 40°C maximum”, on a mild cycle (clevercare, GINETEX).
  Source: clevercare, GINETEX (clevercare.info)
- A copolymer with 2 to 7% of a vinyl comonomer such as vinyl acetate gives “fibres that soften enough to allow penetration by dyestuffs” (Britannica), and a sulphonate comonomer adds the dye sites that let acrylic take bright basic (cationic) dyes (Monsanto patent).
  Source: Monsanto patent (patents.google.com)
- With commercial regains of 1.5% and 13.6% (IS 13157), it is 5.13% and 1,001.24 kg.
  Source: IS 13157 (archive.org)
- Solution-dyed acrylic, with the pigment added before spinning, provides “superior resistance to UV rays and harsh weather conditions, effectively preventing fading” (Aksa, Acrysole); in awnings and outdoor furnishing fabrics acrylic accounts “for more than 90% of production” (Rosa, Rosace and Trovato, Polymers, 2024).
  Source: Aksa, Acrysole (aksa.com)
- Carbon fibre precursor is a special grade of 90 to 99% acrylonitrile (Montefibre patent); see carbon fibre.
  Source: Montefibre patent (patents.google.com)
- World output was “just under 1.6 million tonnes” in 2024, down from 1.7 million in 2020, and only 0.8% of it was recycled (Textile Exchange, Materials Market Report 2025).
  Source: Textile Exchange, Materials Market Report 2025 (textileexchange.org)
- Aksa, Türkiye, describes itself as “the world’s largest producer of acrylic fiber”, with 355,000 tonnes a year of capacity, 271,000 tonnes shipped in 2025 and “global market share” of 23% (Aksa, integrated annual report 2025).
  Source: Aksa, integrated annual report 2025 (asset.aksa.com)

Revision questions

The questions readers ask most, with the article's own answer.

Is acrylic “artificial wool”?

That is how it is sold, and it is what the fibre was designed for.

Is acrylic warm?

Yes, for its weight. Acrylic fibres “are soft and flexible, producing lightweight, lofty yarns” (Britannica), and Vardhman Acrylics lists its fibre as “Warm and high bulk” (Vardhman).

Is acrylic safe to wear?

The hazard is in the factory, not the finished fibre. In 2024 the International Agency for Research on Cancer moved acrylonitrile, the monomer acrylic is made from, from “possibly carcinogenic” (Group 2B, 1998) to “carcinogenic to humans (Group 1) on the basis of sufficient evidence for cancer in humans for lung cancer”.

Test yourself

Ten questions on this topic. Answer them without looking, then check on the last page.

1. By law, what minimum share of the polymer in an acrylic fibre must be acrylonitrile?
2. How does US law (16 CFR 303.7) define modacrylic by acrylonitrile content?
3. What gives modacrylic fibres their notable flame resistance?
4. Why can polyacrylonitrile (PAN) not be melt-spun?
5. In the dry spinning of acrylic, how is the DMF solvent removed?
6. How does the cross-section of dry-spun acrylic differ from that of wet-spun acrylic?
7. How much moisture does acrylic hold compared with wool at standard conditions?
8. What is the limiting oxygen index of acrylic, and at what temperature does it soften?
9. What is the glass transition temperature of acrylic in water and dry (Vardhman)?
10. Which was the first commercially manufactured acrylic fibre, and in what year?

Answers

Each answer is stated in the article; the section to read again is named after it.

1. **At least 85%.**
   See: Opening
2. **Less than 85% but at least 35% by weight of acrylonitrile units.**
   See: What counts as acrylic: acrylic and modacrylic
3. **Chlorine from their chlorine-containing comonomers.**
   See: What counts as acrylic: acrylic and modacrylic
4. **It decomposes before it melts, so it is dissolved and spun from solution instead.**
   See: How acrylic fibre is made
5. **It is evaporated from the solution using hot air.**
   See: How acrylic fibre is made
6. **Dry-spun has a double-T section; wet-spun has a kidney or round section.**
   See: How acrylic fibre is made
7. **Acrylic 1.5 to 2%; wool 13.6%.**
   See: Is acrylic “artificial wool”?
8. **18; it softens around 220–240 °C.**
   See: Pros and cons of acrylic
9. **70–80 °C in water; 95–105 °C dry.**
   See: Properties of acrylic fibre
10. **Orlon, in 1950.**
    See: A short history of acrylic

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