# MATERIAL AGES

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Until the start of the 21st century, the idea of a truly circular materials world seemed far-fetched at best. Yes, we were able to create fibres with ever more incredible qualities, from a mind-blowing range of sources – but the ability to turn those same fibres back into high-quality materials for future use was not yet viable. The launch of Teijin's commercial fibre-to-fibre recycling technology in 2006 altered this reality and promised a step change in the way we produced and perceived recycled textiles: not as inferior downcycled materials but as regenerative and continuous resources.

It's 15 years since Teijin's innovation rocked the textiles world and while the technology failed to reach scale, full circularity is finally beginning to feel within our grasp. Today, it has never felt more important to stop our precious resources ending up in landfill or leaking fibres into our environment and oceans. It has flipped the practice of materials design and recycling from a reactive approach based on upcycling to a more proactive one based on recovery and regeneration. The essential aim is to start with the end at the beginning and prepare materials for recycling in the future.

If we take a longer view on materials development, this is not the only time in its history that we can pinpoint a fundamental shift in the very nature of our relationship with the resources around us. When we look from this more holistic perspective, we can identify three clear Material Ages, each providing a world-changing shift in innovation and propelling us forward to the next materials revolution.

Our ability to use nature's resources in ever more astonishing ways has shifted more in the last 200 years than the previous 8,000, powered largely by our ability to synthesise and chemically transform them. This has provided an abundance of 'stuff' to meet the world's increasing needs and, of course, has not been without consequence.

In order to move forward into the next materials revolution with sustainability and equity at its heart, we must reconsider our relationship with the materials we use, to respect our valuable resources and retain their value for future generations. Recovery technologies are poised to launch us into this next stage and, in the process, reinvent our current materials stocks and waste streams as the ultimate renewable resources of the future.

## 'THE AGE OF NATURALS' *From 6000BC to the 19th century*

## 'THE AGE OF SYNTHETICS' *The 20th century*

## 'THE AGE OF RECOVERY' *Towards 2050*

# ‘THE AGE OF NATURALS’

# FROM 6000BC TO THE 19TH CENTURY

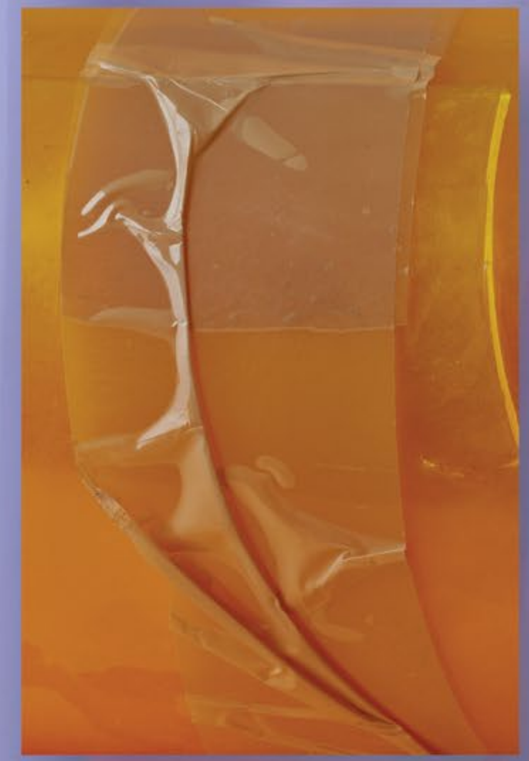
MATERIAL AGE 1: NATURAL MATERIALS
(WOOL, SILK, BAST FIBRES, COTTON)

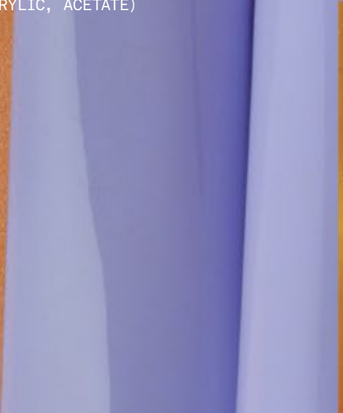
For nearly 8,000 years we used materials almost as they were found in nature, and we continue to use these materials today. Fibres were grown and extracted from crops (cotton, flax/linen, hemp) or sourced from animals (wool, leather, silk). This small palette of materials was produced using low-tech methods and while the Industrial Revolution of the 18th and 19th centuries increased capacity and refined the fabrics produced, the materials and resources remained virtually unchanged.

# ‘THE AGE OF SYNTHETICS’

# THE 20TH CENTURY

MATERIAL AGE 2: MAN-MADE MATERIALS
(ACRYLIC, ACETATE)





Following the creation of the first artificial fibre in the 1880s, the next 100 years saw an explosion of chemically transformed new fibres. Synthetics dominated (polyester, nylon, acrylic, polypropylene) but not all were oil-based plastics. Semi-synthetics or regenerated cellulosics (viscose, acetate, triacetate, lyocell) were also developed during this period. An ever-expanding supply of raw materials included those derived from waste. Predictions indicate that by 2025 we will produce 90.5 million tonnes of polyester annually and more than 93% of future fibre production will be polyester.

# ‘THE AGE OF RECOVERY’

MATERIAL AGE 3: EMERGING MATERIALS (RECOVERED SYNTHETICS, REGENERATED CELLULOSE)

FEATURING:
MALAI, MALAI.ECO
MYCELIUM TILE BY TY SYML, TYSYML.COM
ORANGE FIBRE, ORANGEFIBER.IT
PALM LEATHER, TJEERDVEENHOVEN.COM
PINATEX BY ANANAS ANAM, ANANAS-ANAM.COM
PLASTICIET, PLASTICIET.COM
REFIBRA BY LENZING, TENCEL.COM
SMILE PLASTICS, SMILE-PLASTICS.COM

# TOWARDS 2050

While the chemical recovery of post-use fibres became possible early on in this era, there has been very little development in recent decades in terms of material outputs. We are still producing the same few man-made materials – polyesters, regenerated cellulosics and synthesised biomaterials. The real innovation now emerging is the creation of those materials not only from end-of-life textiles but also process wastes from other agricultural or industrial systems. Recovered synthetics, biopolymers, regenerated celluloses and engineered proteins can all be made from the most unexpected sources, from methane to milk, coffee to keratin. Can we reach full circularity by 2050?