# Objectives

- Be able to recognise a range of modern materials
- Know what Kevlar, Precious Metal Clay, High Density Modelling Foam and Polymorph are.
- Explain how modern materials can be used to alter functionality

# Modern materials

- New and improved materials are constantly being discovered and developed
- Modern materials can help to solve:
  - design issues
  - technical constraints
  - environmental issues
- Which non-stick modern material is used to coat some kitchen equipment?

# What is a modern material?

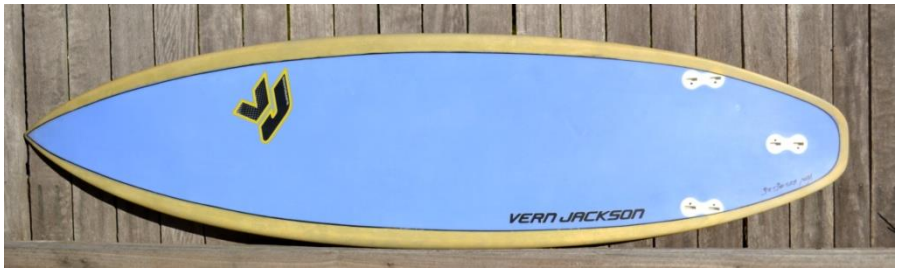
- Modern materials are new inventions or one that has been relatively recently discovered
- A material or element may also be used or combined in a way that is different from its normal function
  - It might be blended, coated, alloyed or treated to improve its functional or aesthetic properties

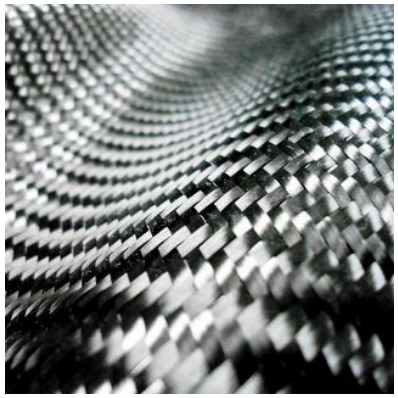
# Kevlar

- Kevlar is an organic fibre in the aromatic polyamide family.
- Kevlar has a unique combination of high strength, toughness and is heat resistant.
- Kevlar's amazing properties are partly due to its internal structure and partly due to the way it's made into fibres that are knitted tightly together.
- *Aromatic* means Kevlar's molecules have a strong, ring-like structure like that of benzene.
- *Polyamide* means the ring-like aromatic molecules connect together to form long chains. These run inside (and parallel to) the fibres of Kevlar a bit like the steel bars in reinforced concrete.

# Kevlar





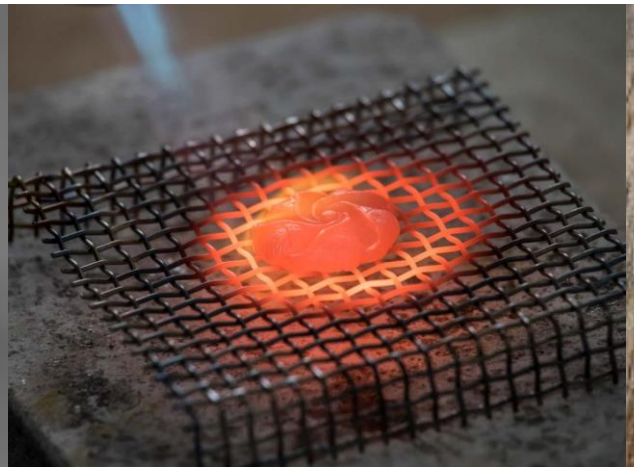



**And what's bad?**

- Kevlar also has its drawbacks, it has very poor *compressive* strength (resistance to squashing or squeezing). That's why Kevlar isn't used instead of steel as a primary building material in structures where compressive forces are common.

# Precious Metal Clay (PMC)


- **Metal clay** consists of very small particles of metal such as silver, gold, bronze, or copper mixed with an organic binder and water for use in making jewellery, beads and small sculptures.
- Originating in Japan in 1990, metal clay can be shaped just like any soft clay, by hand or using moulds.
- After drying, the clay can be fired in a variety of ways such as in a kiln, with a handheld gas torch, or on a gas stove, depending on the type of clay and the metal in it. The binder burns away, leaving the pure sintered metal.



# High Density Modelling Foam

- Polyurethane closed cell rigid foam, ideal for 3D prototyping and modelling with a CNC router.
- It can be machined at high speed with minimal tool wear.
- High density foam, has structural strength and ability to hold surface detail, is ideal for finished models.
- The high density foam can also be used as a mould for vacuum forming.
- Can be worked on by machine or hand tools.




# Polymorph and Coolmorph™


- Polycaprolactone (PCL) is a low temperature, hand-mouldable polymer
- Polymorph fuses at 62°C, although Coolmorph™ bonds together at just 42°C making it easier to use
  - They are both biodegradable, non-toxic and can be coloured
  - They are ideal for modelling as they can be shaped using only hand pressure
  - They can be reused and remoulded multiple times