Objectives

- Understand how material properties can be enhanced by combining two or more materials
- Recognise a range of composite materials and technical textiles
- Understand how fibres can be manipulated to create technical textiles
What is a composite material?

• What materials are used to make concrete?
  • How can concrete be made even stronger to resist compressive forces?
Types of reinforced plastic

• Glass reinforced plastic (GRP)

• Carbon fibre reinforced plastic (CRP)

• What are the main differences between the two types of reinforced plastics?

• For which applications might CRP function better than GRP?

• Both methods use thermosetting resins which produce volatile organic compounds (VOCs)

• A catalyst is added to the resin to make it harden or ‘cure’

• What precautions should you take when working with VOCs?
GRP (CRP) process

• Step by step process to construct a GRP (CRP) part

1. Prepare the mould or former
2. Apply a release agent to the mould
3. Apply a gel coat for GRP (or first resin coat for CRP)
4. Apply the glass fibre matting (or woven carbon fibre)
5. Work a second coat of resin into the material
6. Repeat layers of matting and resin coats to achieve correct thickness for the specific application
7. Clamp and leave a GRP workpiece to cure (Seal a CRP workpiece in a vacuum bag and heat in an oven to cure)
8. Release from the mould, trim and finish workpiece
Worksheet 5

• Complete Tasks 1 and 2 of the worksheet
Technical textiles

• The increased functionality of a technical textile can include:
  
  • Weatherproofing
  
  • Strengthening
  
  • Adding conductivity and insulation, both thermally and electrically

• What protection would firefighters expect from their clothing?
Gore-Tex®

- Gore-Tex® is a special fabric membrane that is waterproof yet breathable
- Which types of clothing would benefit from this?
How Gore-Tex® works

- The membrane has 150 million holes per cm$^2$
  - This means water droplets are too big to pass through
  - Perspiration can still escape as water vapour
Aramids (Aromatic polyamide)

- Aramids are particularly tough fibres made from modified polyamide
- They offer:
  - Cut and tear resistance
  - Flame proofing
  - Thermal insulation
  - High strength
  - A hard wearing finish
- Nomex® and Kevlar® are both types of aramid
Flameproof or flame retardant

• What is the difference?

  • How are sofas and bedding protected from catching alight?
Conductive fabrics and threads

• E-textiles allow electricity to travel along special threads which are either woven or sewn into fabrics
  • Stainless steel or other conductive strands are mixed with other fibres providing flexibility
  • The thread can be soldered onto special sew-on components

• How might conductive thread be used to operate touch sensitive electronics in Arctic conditions?
Microfibres

- Microfibres are less than one denier thick - that’s one fifth the width of a human hair
  - They create an electrostatic charge that attracts particles of dust
  - Usually made from polyester and polyamide
- Which common products contain microfibres?
Microfibre: good or bad?

• Microfibre is a very useful material, however:
  • It can be flammable unless treated
  • It is synthetic and not renewable
  • It takes many years to decompose

• There is growing evidence that microfibres are causing oceanic pollution and entering our food chain
Microencapsulation

• Solids, liquids or gasses are sealed in tiny capsules
  • These active ingredients can be released at controlled rates and under controlled conditions

• Active ingredients include:
  • Thermochromic dyes
  • Antibacterial material
  • Pesticides
  • Perfumes
  • Pharmaceuticals
Plenary

• Using your knowledge of composite materials and technical textiles, complete Task 3 of the worksheet
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