



Design Technology: Alcoa Kitts Green – Teacher Guide

Context

The Alcoa manufacturing plant at Kitts Green, Birmingham, produces high quality, flat rolled aluminium. From Spitfire to Airbus, almost all aircraft made in the UK have used aluminium from Kitts Green in their construction. Worldwide, Kitts Green plate is used by all major airframe builders in Europe, the Far East and the USA, as well as for military vehicles and Formula 1 cars.

Originally set up in 1938, the plant currently has over 500 employees. In 2014 it was the winner of the best process plant at the UK Best Factory awards. The demand for its products is such that sales turnover is capacity constrained – it can sell everything it makes.

All the processes involved in manufacturing plate material from aluminium alloy take place within the plant. Aluminium alloy ingots are cast from the liquid metal, and these ingots are rolled into plate. Ultrasound testing is used to detect and evaluate defects in the rolled products.

Objectives

The virtual field trip to Alcoa Kitts Green and the associated learning activities can be used to support the following learning objectives:

- Select from and use a wider, more complex range of materials, components and ingredients, taking into account their properties (*Key Stage 3, National Curriculum for Design and Technology*)
- Understand and use the properties of materials and the performance of structural elements to achieve functioning solutions (*Key Stage 3, National Curriculum for Design and Technology*)
- Consider health and safety in all of its aspects (*GCSE Design & Technology*)
- Be aware of current commercial/industrial processes (*GCSE Design & Technology*)
- Understand how metals are used, processed for use, and how they can be recycled (*GCSE Resistant Materials, GCSE Product Design, GCSE Engineering*)
- Recognise the working characteristics of common forms of metals, and know that they can be combined to form alloys (*GCSE Resistant Materials, GCSE Engineering*)
- Understand energy use in manufacturing (*GCSE Engineering*)

Learning activities

Students could:

- Carry out a risk assessment for either one section of the process (such as casting the ingots or rolling the plate) or for the full process:
 - What are the potential hazards?
 - What are the risks from these hazards?
 - What control measures are used to minimise these risks?

(*Supporting resources: Risk Assessment PowerPoint and worksheet*)

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- Produce a flow chart showing how recycled aluminium becomes finished plate. This should detail all of the processes and equipment used.
- Carry out a product analysis of an aluminium product, such as a drinks can. This could use an approach that the learners are familiar with, such as ACCESS FM or CAFÉ QUE. What are the properties that make aluminium suitable for this product? How does it get these properties? What other products would these properties make it suitable for?

(Supporting resources: ACCESS FM PowerPoint and worksheet)

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- Make a list of all the different resources that are used during the manufacture of the aluminium plate; this should include the material, water and energy. For each, describe how it is used (for example, energy is used in the plant ranging from melting the recycled aluminium and heating the ingots, to powering the rollers, computer screens and even the lighting) and any steps being taken to reduce the impact on the environment (for example, use of recycled aluminium, cleaning and recirculation of water etc.).
- Carry out a 1, 2, 3 review of the virtual field trip, detailing:
 - 1 thing you already knew
 - 2 questions that you need to ask
 - The 3 most important things that you learnt today.

(Supporting resources: 123 Review PowerPoint and worksheet)

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- Careers activity: Create a table with two columns. In the first column, list the job role of each of the people introduced during the virtual field trip. In the second column, list the education and training that supported each person in achieving their job role.

Key questions

- What control and safety measures are put in place at Alcoa to minimise risk to workers?
- What are the potential hazards, risks and associated control measures in rolling sheet aluminium?
- Why is aluminium a suitable material for making a drinks can?
- What are the properties of aluminium? How does adding additional metal to aluminium affect its properties?
- What resources are used in the manufacture of aluminium plate?

Keywords

Keyword	Definition
aluminium	A non-ferrous metal extracted from bauxite clay via a smelting process.
alloy	A mixture of two or more metals, normally giving properties that are better than the pure metal.



ingot	A solid block of metal made by casting molten metal.
non-ferrous metal	Metals that do not contain iron. Examples are aluminium, copper, lead and tin. Have good resistance to corrosion.
plate mill	A manufacturing plant that uses rollers to reduce the thickness of a cast slab.
ultrasonic non-destructive testing	An inspection method that uses ultrasonic sound waves to detect defects in a material.