

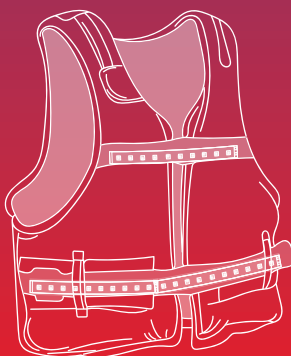
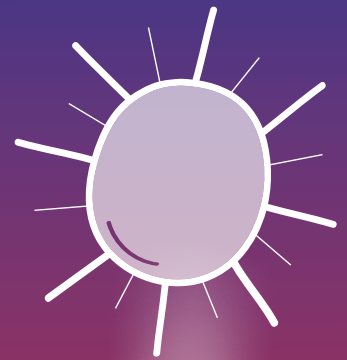
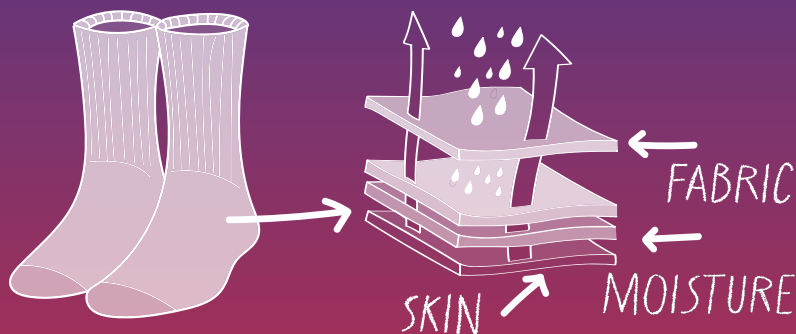
DREAM. BUILD. BECOME.

ACE METAL
FOUNDATIONS

By IACMI

Smart Textiles

MOISTURE WICKING FABRIC



LED SAFETY VEST



UV ACTIVATED CLOTHING

Smart Textiles



Prior Knowledge

Students should have basic experience with drawing or painting and be able to safely use paint brushes. Students should be able to follow simple, multi-step directions and observe visible changes over time.

Smart Textiles

Lesson Overview

In this lesson, students are introduced to smart textiles through a hands-on design activity using color-changing paint and glow-in-the-dark paint on wearable fabric. Students explore how certain materials can respond to changes in their environment, such as heat and light, and observe how these changes affect the appearance and function of the textile.

This activity is designed as an early learning exposure to advanced manufacturing concepts. Students begin to understand that modern manufacturing is not only about making things, but about choosing materials, designing for specific purposes, and creating products that respond to real-world conditions. By working with smart paints, students see how technology can be embedded directly into everyday materials like clothing.

Rather than focusing on complex electronics or technical processes, the lesson emphasizes curiosity, observation, and design thinking. Students learn that engineers and manufacturers design smart materials intentionally—thinking ahead about how products will be used, who will benefit from them, and how they interact with their surroundings. Through this experience, students build early awareness that advanced manufacturing combines creativity, science, and purposeful design to solve problems and improve everyday life.

Vocabulary

Smart Textile: Fabric materials that contain special structures or materials that allow the fabric to react to changes in the environment, such as heat or light

Technology: The application of scientific knowledge for practical purposes, helping people solve problems or improve everyday objects

Design: A plan for how something will look or work in order to solve a problem or meet a need

Material: What something is made of; engineers choose materials based on how they behave and what they can do

Smart Textiles

The Foundations of Smart Textiles

Have you ever seen clothing that changes color or glows in the dark? These changes don't happen by accident. They are designed.

Smart textiles are fabrics that are made to react to their surroundings. Some smart textiles respond to heat, some respond to light, and others respond to movement. Engineers and manufacturers carefully choose materials that can change in visible ways when something in the environment changes.

Many smart materials respond to their environment. Heat from the sun, warmth from your body, or darkness in a room can all cause a smart material to behave differently. Engineers study how materials react to these conditions, so they can design fabrics that work the way they want them to.

In advanced manufacturing, people do not just make clothes look nice. They think about what the fabric should do. A shirt might need to change color when it gets hot, glow so it can be seen in the dark, or help keep someone safe. Manufacturers test materials, observe how they respond, and improve designs, so the final product works well in real life.

In this activity, you are exploring these same ideas. By using glow-in-the-dark paint you will experience how smart textiles are designed to respond to their environment. Just like engineers, you will plan a design, test how it works, and think about how materials can be used to solve problems or improve everyday objects.

Materials

Materials Supplied in Kit

Per Student

- 1 bucket hat
- 1 paint brush

Shared

- Glow-in-the-dark paint

Materials Supplied by Teacher

- Table coverings or cardboard to protect work surfaces
- Drying area for painted textiles



Smart Textiles

Activity Directions

Step 1: Preparation and Material Distribution

- If desired, cover student workspaces with paper or cardboard to help protect desks and tables
- Each student should have 1 brush, 1 bucket hat, and access to share the glow-in-the-dark paint with others

Step 2: Design the smart textile and allow the paint to dry

Step 3: Test the Smart Textile

- Glow-in-the-dark paint works similarly to a flashlight battery. Before the students' textiles can be tested, they will need to spend some time under some lights, or the sun.



Figure 1: Smart textiles and LED safety vests help keep workers visible and safe in low-light conditions.



Figure 2: A smartwatch uses smart textile technology and sensors to collect and display useful information in real time.

Discussion Prompts or Reflection

- How did your smart textile behave differently from regular clothing?
- Why might someone want to use smart materials, like glow-in-the-dark paint?
- How could glowing clothing help keep people safe?
- What other materials do you think could be added to clothing to make it "smart"?

Smart Textiles

Variations and Enrichment

- This activity can be extended by testing smart textiles in different environments, such as comparing results indoors versus outdoors on a sunny day. Students may observe that heat and light affect materials differently depending on location, just as manufacturers must consider where and how products will be used.
- To deepen observation skills, students can test their textiles under different levels of light, such as shade versus direct sunlight, or a dim room versus complete darkness. This helps students understand that smart materials can respond differently depending on conditions.
- Enrichment can include prompting students to redesign part of their textile after testing. Students may add more paint, adjust placement, or change colors, reinforcing the idea that engineers and manufacturers improve products through repeated testing and redesign.
- Teachers may also introduce a real-world challenge, such as asking students to design a smart textile for safety, performance, or fashion. This connects the activity to how advanced manufacturing solves problems by designing materials for specific purposes.

Foundation Exploration

- **Clothing designers** sometimes choose smart materials that reduce sweat, increase airflow, glow in the dark, or even light up
- **Materials testers** check materials to see how they react to things like light or movement. They test materials to make sure they work the way they should
- **Technology designers** think about new ways to add special features to everyday items. They help decide when something should glow, shine, or stand out
- **Factory workers** rely on smart materials that may reflect light, glow, or make sound to alert them to potential danger