

MERIT BADGE SERIES



# COMPOSITE MATERIALS



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*"Enhancing our youths' competitive edge through merit badges"*



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# Requirements

1. Do the following:
  - a. Explain to your counselor the most likely hazards you may encounter while working with composite materials and what you should do to anticipate, mitigate and prevent, and respond to these hazards. Describe the appropriate safety gear and clothing that should be used when working with composite materials.
  - b. Explain the precautions that must be taken when handling, storing, and disposing of resins, reinforcements, and other materials used in composites. Include in your discussion the importance of health, safety, and environmental responsibility and awareness.
  - c. Describe what a material safety data sheet (MSDS) is and tell why it is used.
2. Do the following:
  - a. Explain what composite materials are. Include a brief history of composites and how they have developed.
  - b. Compare the similarities and differences between composites and wood, aluminum, copper, and steel. Describe the physical, electrical, mechanical, corrosive, flammability, cost, and other such properties. For each of these raw materials, give one example of how it can be shaped and used for a specific application.
3. Describe how composite materials are made. Then do the following:
  - a. Discuss three different composite reinforcement materials, their positive and negative characteristics, and their uses. Obtain the MSDS for each one and discuss the toxicity, disposal, and safe-handling sections for these materials.

- b. Discuss three different resins used in composites, their positive and negative characteristics, and their uses. Obtain the MSDS for each one and discuss the toxicity, disposal, and safe-handling sections for these materials. Include thermoset resins and thermoplastic resins in your discussion.
    - c. For each of the three resins you chose for requirement 3b, think of a new application that might be worth developing.
  4. With your parent's permission and your counselor's approval, do ONE of the following:
    - a. Visit a company that manufactures or repairs products made with composites. Discuss what you learn with your counselor.
    - b. Find three composites-related websites. Share and discuss what you learn with your counselor.
  5. Do the following:
    - a. Use composite materials to complete two projects, at least one of which must come from the *Composite Materials* merit badge pamphlet. The second project may come from the pamphlet OR may be one you select on your own that has been approved by your counselor in advance.
    - b. With your counselor's assistance, find an appropriate site where the projects can be safely completed under your counselor's supervision and/or the supervision of an adult approved by your counselor who is knowledgeable about composites.
    - c. With your counselor, determine how the finished projects will be evaluated. Using those guidelines, evaluate the completed projects with your counselor.
  6. Find out about three career opportunities in composite materials. Pick one and find out the education, training, and experience required for this profession. Discuss this with your counselor, and explain why this profession might interest you.

# Composite Materials Resources

## Scouting Literature

*Chemistry, Engineering, Inventing, Model Design and Building, Robotics, and Space Exploration* merit badge pamphlets

Visit the Boy Scouts of America's official retail website (with your parent's permission) at <http://www.scoutstuff.org> for a complete listing of all merit badge pamphlets and other helpful Scouting materials and supplies.

## Books

Marshall, Andrew C. *Composite Basics*, 7th ed. Marshall Consulting Publishing, 2005.

Rutan, Burt. *Moldless Composite Sandwich Aircraft Construction*. Rutan Aircraft, 2005.

Strong, A. Brent. *Fundamentals of Composites Manufacturing: Materials, Methods, and Applications*. Society of Manufacturing Engineers, 2007.

## Periodicals

### **Composites Manufacturing**

American Composites Manufacturers Association  
Telephone: 703-525-0511  
Website: <http://www.acmanet.org/cm-magazine>

### **Composites Technology**

Gardner Publications Inc.  
Telephone: 513-527-8800  
Website: <http://www.compositesworld.com>



The Boy Scouts of America gives special thanks to the American Composites Manufacturers Association for its assistance with the development and production of the *Composite Materials* merit badge pamphlet.

For more information about composites, visit the ACMA's website at <http://www.acmanet.org>.

## Organizations and Websites

### American Composites Manufacturers Association

Website: <http://www.acmanet.org>

### American Society for Composites

Department of Civil and Environmental Engineering and Engineering Mechanics  
University of Dayton

Website: <http://www.asc-composites.org>

### Center for Composite Materials

University of Delaware  
Telephone: 302-831-8149  
Website: <http://www.ccm.udel.edu>

### CompositesWorld

Website:  
<http://www.compositesworld.com>

### MSDS Online

Website: <http://www.ilpi.com/msds>

### NetComposites

Website: <http://www.netcomposites.com>

### Occupational Safety and Health Administration

Toll-free telephone: 800-321-6742  
Composites safety website:  
<http://www.osha.gov/SLTC/composites/index.html>

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