

ASM MATERIALS Camp[®]-Teachers

Materials Science and Technology

Overview of Curriculum

Background

The program is based on past experiences in the areas of curriculum development, teacher training and student programs in Materials Science developed at the University of Washington and Edmonds Community College and supported by the National Science Foundations Advanced Technology Education program. These programs have demonstrated that Materials Science is an excellent tool to bring together academic and vocational instructors in a common goal of exciting students about science, technology and engineering.

Philosophy

Materials Science excites students' interest because the student has everyday, hands-on experience with materials. Thus, materials topics are great motivators in any engineering, technology or science course. Materials are also a very important and an integral part of the manufacturing process.

Curriculum

During this one-week workshop, teacher participants will learn the basics of Materials Science Technology as taught at the high school level. They will work hands-on with metals, ceramics, polymers and composites, and will develop a greater appreciation for the importance of these materials to modern life. The teachers will see how this heavily project-based course excites students to learn science concepts as they complete projects of personal worth to them. Whether teachers use the information and concepts as a basis for teaching their own MST course or merely infuse the concepts into an existing science course to increase relevancy, they will finish the week prepared to make some important instructional changes as a result of their participation.

SOLIDS

Topics

- Importance of materials
- Four categories of solids
- Simple chemistry made easy
- Chemical bonding
- Periodic Table of Elements – it can be useful and fun to learn
- Oxidation-reduction

Experiments/Labs

- Identification of Materials
- Formation of Crystals
- Destructive Testing
- Activity Series of Metals
- Oxidation/Reduction of Copper

METALS

Topics

- History of metals and use
- Properties of metals
- Mechanical properties
- Effects of heat treating
- Types of alloys; alloying techniques
- Phase diagrams
- Testing metals
- Manufacturing processes

Experiments/Labs

- Rolling a Coin
- Drawing a Wire
- Alloying Copper and Zinc
- Actual Cost of a Penny
- Making a Light Bulb
- Making Tin-Lead Solder
- Annealing Copper
- Powder Metallurgy
- Lost Wax Casting

Project

- Making sterling silver jewelry via lost wax casting techniques

CERAMICS/GLASS

Topics

- Ceramics are crystalline solids
- Ionic and covalent bonds
- Glass properties are different: amorphous structure
- Manufacturing processes

Experiments/Labs

- Forming, Firing, and Glazing Clay
- Thermal Shock
- Glass Bending and Blowing
- Glass Batching and Melting
- Dragon Dribble/Dragon Tears
- Coloring Glass
- Ceramic Slip Casting

Project

- Making Raku
- Melt and pour liquid glass

POLYMERS

Topics

- Classification of polymers
- Altering chemically or with additives
- Recycling concerns
- Chemical changes through cross-linking
- Synthetic polymers & chemistry involved
- Historical developments
- Manufacturing processes

Experiments/Labs

- Cross-Linking a Polymer
- Polymer Identification
- Making Nylon 6-10
- Latex Rubber Ball
- Memory in Polymers
- Epoxy Resin Cast
- Polymer Foam Creations

Project

- Slime

COMPOSITES

Topics

- Types of composites and categories
- Strength-to-weight ratios
- Strength measuring, testing, altering
- Wood and concrete: traditional composites
- Fiber reinforced composites
- Graphite and Kevlar fibers

Experiments/Labs

- Stressed-Skin Composites
- Compression and Tension in a Bending Beam
- Using Portland Cement to Make & Test Concrete
- Hand Lay-Up of a Glass Fiber Reinforced Polymer
- Plaster of Paris Matrix Composite
- Laminated Wood Beams