

## Module 300 – Lesson One: INTRODUCTION TO METALS

### ***Lesson Description:***

Introduction to metal identification and characteristics. Identification of ferrous and nonferrous metals explaining the main difference between them. Overview of basic metal types, properties and qualities. Introduction to handling coated material and scrap. Determining the affects of material variation on a process and the effects of forming with and against the grain. Students will learn how to confirm material specs found on the material tag. *Prerequisite:* None

### ***Learning Objectives:***

At the completion of this lesson, the student will be able to:

- ◆ Name the common properties of metal (characteristics and qualities).
- ◆ Name the element that differentiates ferrous from non-ferrous materials and provide two common examples of each.
- ◆ Name the most important quality of a material when separating scrap (type of material).
- ◆ Given a strip of material, identify the direction of the grain. Identify the effects of bending/forming with and against the grain on the strength of the part.
- ◆ Identify type materials and distinguish metals as ferrous or non-ferrous given samples of mild steel, stainless steel, aluminum, brass and copper.
- ◆ Identify if a material has a coating or cladding and confirm any special handling requirements needed for processing.
- ◆ Recognize selected surface characters (e.g. rust) that impact formability and/or quality.
- ◆ Given material variations (material thickness and width), identify the effects of the variations on formed parts.
- ◆ Given a material tag, control plan and/or inspection plan, confirm material compliance with specifications on the Process/Control Pan or Inspection Sheet/Quality Control Plan.

### ***Methods of Instruction:***

Lecture, “show me” examples, self-study reading, individual projects and presentations, class discussions and real-world examples.

### ***Methods of Evaluation:***

Individual presentations, “show me” demonstrations, and written tests during and after training.

### ***Lesson Materials Provided by PMA:***

- ◆ *PMAEF Student Resource Book – Introduction to Metallurgy*
- ◆ Student Handouts
- ◆ *PMA Instructor Guide* with *SMART* Lesson Plans, *Skill Checks* and *PROficiency Practices & Assessment*.
- ◆ Transparencies
- ◆ Part Examples
- ◆ PMAEF Item Bank (assessment questions) for construction of end of lesson examination.
- ◆ List of recommend student reading and study materials (textbooks, videos, tours, etc.)

☞ Note: Student Workbooks, handouts, transparencies, and item bank provided on CD or disk.

***Lesson Topics & Content Outline:***

◆ **Metalworking & Metal Identification**

What is “Metallurgy?”

Methods of Metalworking (Hot and Cold).

Identification of Common Metals Used in Metalforming.

Metal Characteristics and Properties (physical, chemical and mechanical).

Properties of Metals including but not limited to:

Hardness

Ductility

Malleability

Elasticity.

Examples of Metallic Materials.

Qualities of Metals including but not limited to:

Strength/Tensile Strength

Yield Limit

Corrosiveness

Stress

Weight.

Other Properties of Metals (i.e., conductivity, density, fusibility, etc.).

Using Material Tags, Process/Control Plans and Inspection Sheets.

◆ **Types of Metals**

Ferrous Metals.

Nonferrous Metals.

Work Hardening.

Heat Treatment of Ferrous Metals (Alloyed Steel).

Heat Treatment of Nonferrous Metals (Aluminum Alloys).

Coatings and Cladding.

Quality Characteristics (rust, surface defects, dimensional variations, etc.).

Special Handling, Separating Scrap, Formability of Metals and Related Safety Issues.

◆ **Structure of Metals**

Crystals and Grains.

Material Variations.

❖ **End of Lesson Exam (*PRO*iciency Assessment)**

☞ Note: See individual SMART Lesson Plan contained in the Instructor’s Guide for detailed instruction content, flow of lesson, and assessments. Instructor and students are responsible for obtaining metal samples and documentation.