Matrikulasi Mahasiswa Baru 2017
Jurusan Teknik Mesin

Rekayasa Materials:

Engineering Materials, Materials Engineering and Material Engineers

Disampaikan oleh: SUDARISMAN

Engineering Materials

What are Materials?

- Materials are atoms joined together in the solid state.
- Materials science studies the fundamental physical and chemical basis for the controlled combination of atoms to form new compounds, phases, and microstructures, as well as the characterization of the resulting structures and properties.
- The great diversity of materials reflects the enormous variety in the strength and directionality of atomic bonding.

Engineering Materials

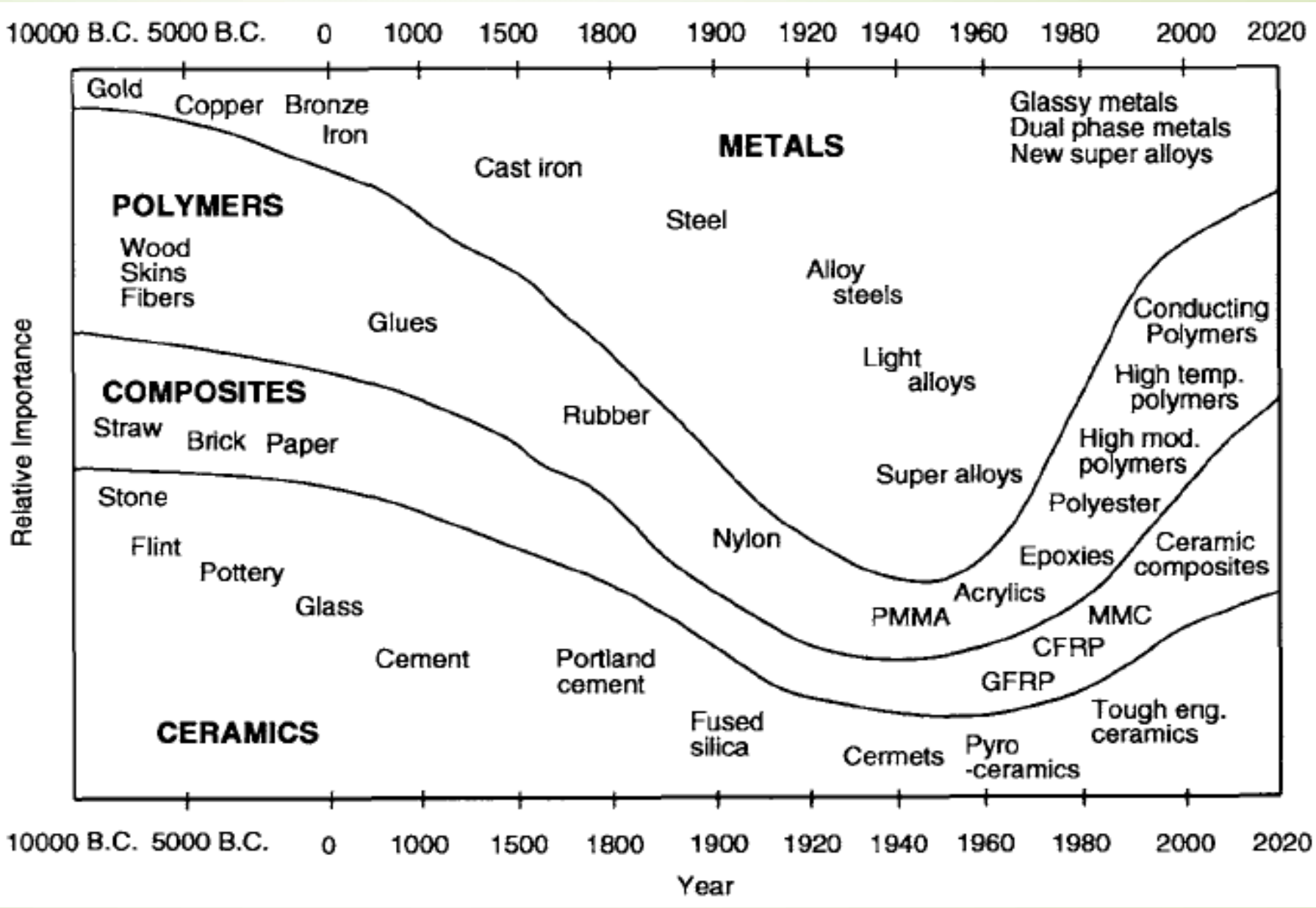
Why is it important?

- *Innovations in materials science and engineering lead to improved materials and solutions to technological, societal, and environmental problems.*
- *Materials Science and Engineering is advancing biomaterials, ceramics, electronic materials, metals, and polymers that affect all engineering areas.*

Evolutions:

- The evolution of engineering materials through the ages is commonly triggered by the need for sophisticated weaponry.

Engineering Materials



Engineering Materials

Classification

Structural materials	**Metals and alloys**	**Besi, baja, aluminium, tembaga, nikel, titanium, magnesium, emas, perak dan paduannya**
	Ceramics	Silikon karbida, silikon nitrida, silika, magnesia, alumina, semen Portland
	Polymers and elastomers	Epoksi, poliester, phenolik, poliamida, poliethilin, polisulfon, polietherether keton, polivinil-chlorida, karet alam
	Composites	Komposit bermatrik polymer (PMCs) Komposit bermatrik keramic (CMCs) Komposit bermatrik logam (MMCs) Komposit karbon/karbon (CCCs)

Engineering Materials

Usages:

- Ferrous metals without specific treatment: common structures.
- Ferrous metals with specific treatment: humid and/or high chemical environment requires ferrous metal with specific surface treatment or stainless steel.
- Non-ferrous metals: used for specific purposes, such as: Cu for electric cable, brass (Cu-Sn alloy) for electric contactors, Pb-Sn alloy used for metals of slide bearings.
- Polymer- and elastomer-based materials: used in low temperature environment, high humidity and chemical contents, mass-constraint structures.

Engineering Materials

Usages:

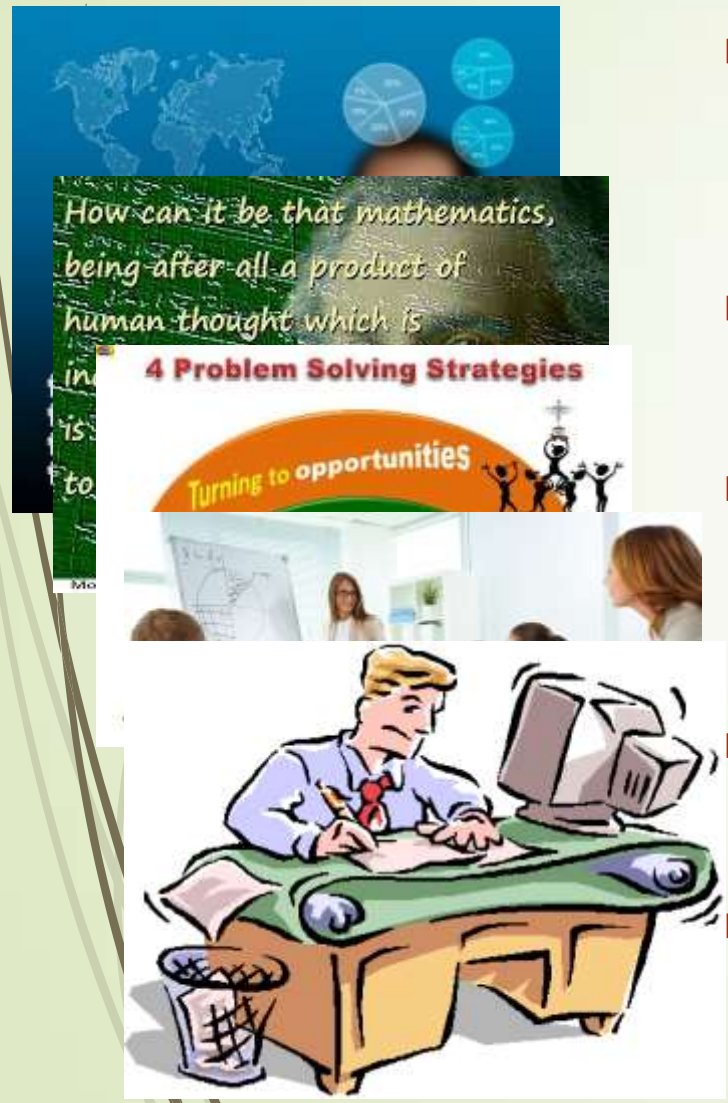
- Ceramic-based materials: used in high temperature environment, friction materials, abrasion materials, cutting tools.
- Composite materials: customized design for specific purposes. Their matrix and filler materials are selected according to loading and environmental conditions, such as: friction materials for brakes and clutches), beams in structures, high pressure vessels and pipes, engine cylinder liner, car bodies, vessel bodies, aero plane bodies, thermal shields for space shuttles.

Materials Engineering

What is Materials Engineering?

- Studies on precursor, processing, structure and properties relationship
- New materials → new technologies → growth, prosperity, security, and quality of life of humans
- A material is chosen for its properties, such as: strength, electrical properties, resistance to heat or corrosion
- Precursor + processing → Structure → properties
- Materials are studied because of their engineering utility, not their scientific beauty

Materials Engineers



Important Qualities

- **Analytical skills**. They must be able to determine how materials will be used and structured to withstand loads.
- **Math skills**. Math principals are required for analysis, design, and troubleshooting in their work
- **Problem-solving skills.** Understanding the relationship between materials' structures and properties are required for failure analysis and design improvement
- **Speaking skills.** Materials engineers with in group of various academic background in designing products.
- **Writing skills.** Needed when writing reports and arranging plans.

Materials Engineers

Specialties:

- ***Ceramic engineers,*** *designing materials, process and products (high-temperature rocket nozzles to LCD flat-panel displays).* *(Mercedes Benx's ceramic brake)*
- ***Composites engineers*** *engineered customized property materials for specific products (aircraft, boats, automobiles)*
- ***Metallurgical engineers*** *specialize in designing metal alloys, and their products.*
- ***Plastics engineers*** *develop and test new plastics, known as polymers, for new applications.*
- ***Semiconductor processing engineers*** *apply materials science and engineering principles to develop new microelectronic materials.*

Materials Engineers

Employers

- ***Power industry***: *oil and gas companies*
- ***Telecommunications***: *developing glass fiber optics to enhance technologies such as broadband*
- ***Sports equipment***: *designing and developing materials (carbon fiber and plastics to produce tougher, lighter equipment or performance textiles)*
- ***Biomedical engineering***: *developing materials for components (heart pace makers or materials for replacement joints, such as knees and hips).*

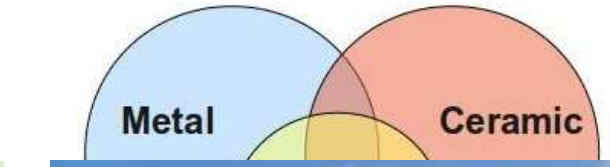
Materials Engineers

Work Environment for Materials Engineers

5 highest of about 25,300 jobs for Materials engineers in 2014 in the US:

- *Aerospace product and parts manufacturing* — *13%*
- *Engineering services* — *11*
- *Primary metal manufacturing* — *10*
- *Computer and electronic product manufacturing* — *10*
- *R and D in physics, engineering, and life sciences* — *8*

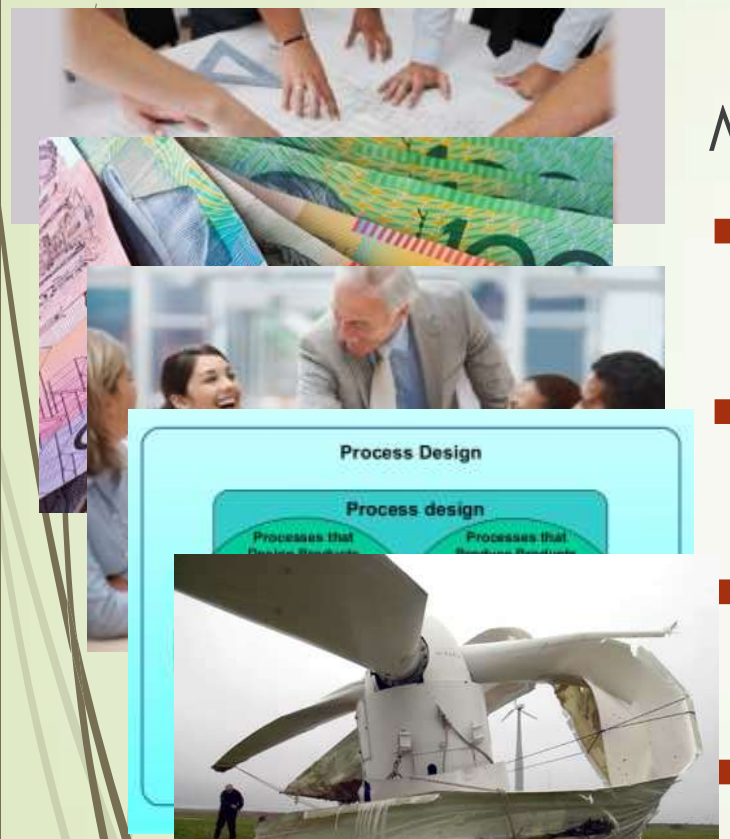
Materials Engineers



Jobs:

- *They are responsible for the research, specification, design and development of materials to advance technologies and products of many kinds.*
- *Their expertise lies in understanding the properties and behaviors of various raw materials to finished products, known as as materials science or materials technology.*
- *They work with many different materials, from ceramics to plastics, and polymers to industrial minerals.*
- *Working in a diverse range of industries, combine or modify materials in different ways to improve the performance, durability and cost-effectiveness of processes and products.*

Materials Engineers

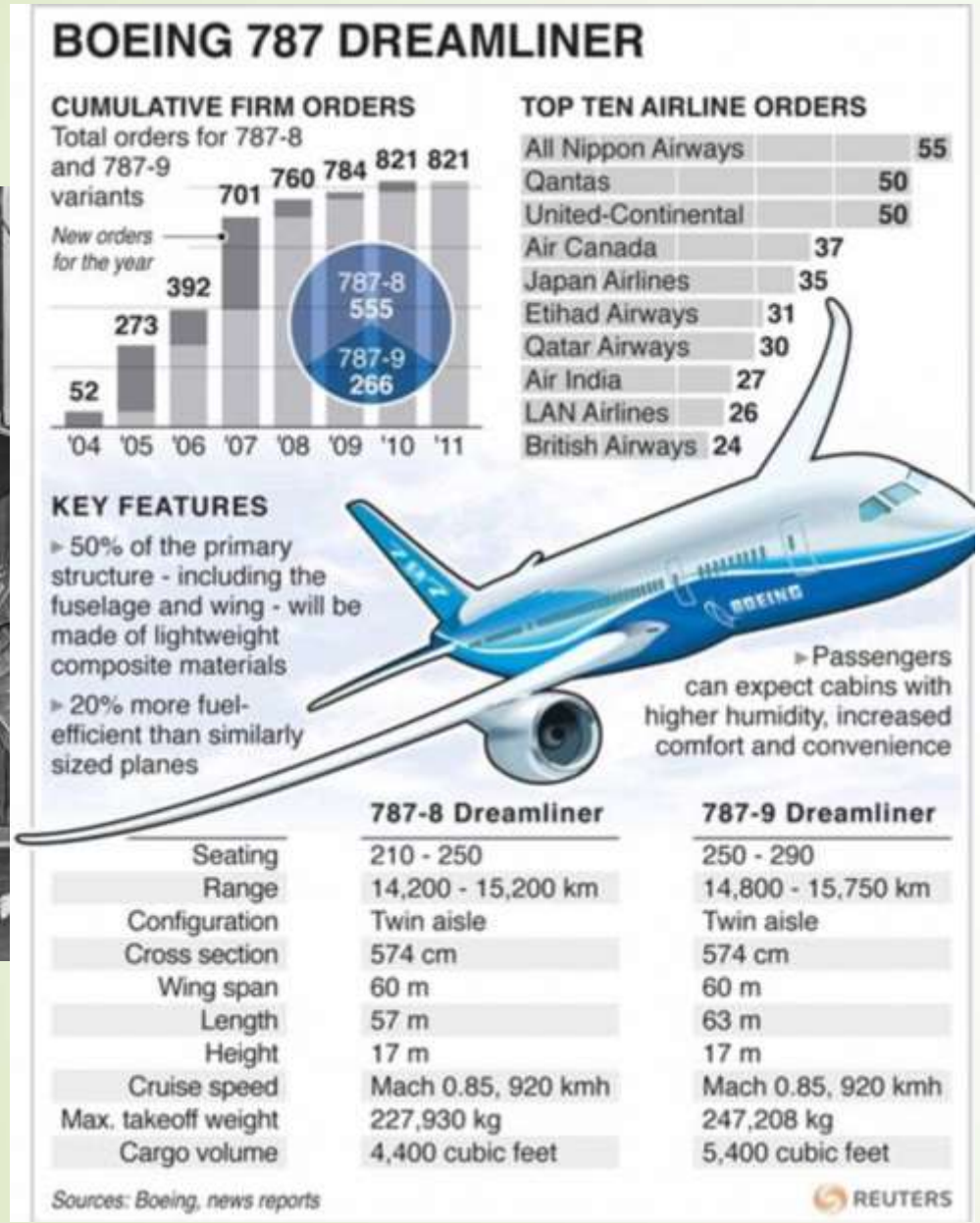


Duties 1:

Materials engineers typically do the following:

- *Plan and evaluate new projects, consulting with other engineers and managers as necessary*
- *Prepare proposals and budgets, analyze labor costs, write reports, and perform other managerial tasks*
- *Supervise the work of technologists, technicians, and other engineers and scientists*
- *Design and direct the testing of processing procedures*
- *Monitor how materials perform and evaluate how they deteriorate*

Materials Engineers



Duties 2:

- *Determine causes of product failure and develop ways of overcoming such failure*
- *Evaluate technical specifications and economic factors relating to the design objectives of processes or products*

Materials Engineers

Responsibilities 1:

Activities common to most positions:

- *selecting the best combination of materials for specific purposes*
- *testing materials to assess how resistant they are to heat, corrosion or chemical attack*
- *analyzing data using computer modelling software*
- *assessing materials for specific qualities (such as electrical conductivity, durability, renewability)*
- *developing prototypes*
- *considering the implications for waste and other environmental pollution issues of any product or process*

Materials Engineers

Responsibilities 2:

- *advising on the adaptability of a plant to new processes and materials*
- *solving problems arising during the manufacturing process or with the finished product, such as those caused by daily wear and tear or a change of environment*
- *supervising quality control throughout the construction and production process*
- *monitoring plant conditions and material reactions during use*
- *helping to ensure that products comply with national and international legal and quality standards*

Materials Engineers

Responsibilities 3:

- *advising on inspection, maintenance and repair procedures*
- *liaising with colleagues in manufacturing, technical and scientific support, purchasing and marketing*
- *supervising the work of materials engineering technicians and other staff*
- *considering the costs implications of materials used and alternatives, in terms of both time and money*
- *taking account of energy usage in manufacturing and in-service energy saving, e.g. in transport and construction applications.*