

1. Overview on DoITPoMS packages

www.msm.cam.ac.uk/doitpoms/



Dissemination of IT for the Promotion of Materials Science (DoITPoMS)

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About DoITPoMS

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1.1 Aims, objectives and resources

To build on recognised expertise in the use of information technology (IT) in enhancing the student learning experience and to disseminate these techniques within the Materials Education community in the UK.

Objectives

- To create a primary archive of photomicrographs, digital video clips, etc, for use by teachers in developing secondary resources, and as a teaching and learning resource in its own right.
- To create a library of exemplar teaching and learning packages (TLPs) covering common topics and making use of video clips and other material from the primary archive.

Resources

To date the following resources have been created and are undergoing continuing development:

- Micrograph Library
- Library of Teaching and Learning Packages

A library of video clips is currently under development.

1.2 Micrograph Library www.doitpoms.ac.uk/miclib

The DoITPoMS Micrograph Library is a collection of materials micrographs intended for use in teaching and learning. The Library currently contains 770 micrographs.

All micrographs in the Library have been contributed by people working in the field of materials science and technology. In addition to the images, the following information (or 'metadata') is stored with each micrograph (some of these fields being optional).

- | | |
|---|---|
| * Brief description | * Keywords |
| * Categories to which micrograph belongs (e.g. ceramic, metal or alloy) | * Composition (e.g. Al 10, Cu 90 (wt%)) |
| * System (e.g. Al ₂ O ₃ , Al-Cu, ...) | * Processing |
| * Reaction | * Sample preparation |
| * Applications | * Further information |
| * Microscopy technique | * Organisation |
| * Contributor | |

Micrographs can be found using search, browse or advanced search. Help is available on each of these methods.

1.3 TLP Library www.doitpoms.ac.uk/tlplib

The TLP Library is a growing collection of self-contained teaching and learning packages, each focuses on a common materials science topic, often related to first-year materials science laboratory work in the Department of Materials Science and Metallurgy. Many TLPs include video clips from experiments, along with an introduction, summary, questions and answers, and references for further study. Check the website for the up-to-date list.

1.4 Video Library www.doitpoms.ac.uk/vidlib/about.php

The DoITPoMS Video Library is a collection of materials science related videos intended for use in teaching and learning. All videos in the Library have been contributed by people working in the field of materials science and technology. In addition to the videos, the following information (or 'metadata') is stored with each video (some of these fields being optional):

- brief description
- duration
- categories to which video belongs (e.g. Animation, Microscopy, ...).

Videos can be found using search, browse or advanced search. Help is available on each of these methods.

2. Using the DoITPoMS packages.

2.1 Library of Teaching and Learning Packages

A. **Introduction to Mechanical testing:** then choose *Results 2* from side menu and look at video links below graph:

- [Full tensile test of annealed copper speeded up 20 times](#) (1.2 MB)
- [Necking of annealed copper speeded up 5 times](#) (330 KB)
- [Full tensile test of work hardened copper speeded up 20 times](#) (560 KB)
- [Necking of work hardened copper speeded up 5 times](#) (490 KB)

You can also view image sequences of the tensile tests which also display the growth of the stress-strain graph:

- [Image sequence with growth of stress-displacement graph for an annealed copper rod](#)
- [Image sequence with growth of stress-displacement graph for a work hardened copper rod](#)

B. **The Ductile – Brittle Transition:** then choose *Results* from side menu and look at video links:

- [copper](#) (38 KB)
- [aluminium](#) (64 KB)
- [acrylic](#) (113 KB)

C. **Beam stiffness:** start with Introduction and work through.

D. **Introduction to dislocations:** some familiarity with dislocations will help with tomorrow's lecture 2.

E. **Choose any other packages of interest – and do ask about concepts involved!**

2.2 Micrograph Library

Some awareness of different alloy systems is needed to make the most of the micrograph library but examples of representative microstructures of different alloy systems are provided below.

A. Start by using Search and entering "brass". Many micrographs will be found showing a range of compositions (different copper zinc ratios), fabrication histories and magnifications. Illustrates complexity of alloy systems! Also try "steels".

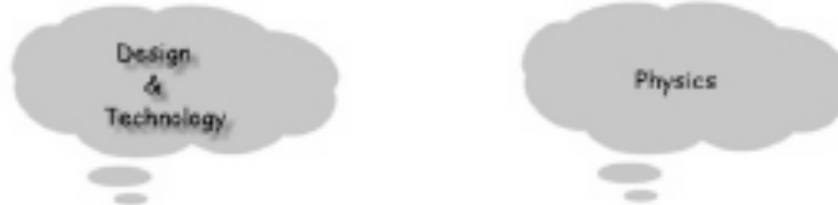
B. Representative alloys:

- Polycrystalline single phase brass: shows equiaxed grains, micrographs 429 and 430
- Polycrystalline two-phase brass: micrograph 442
- Aluminium alloys: effect of deformation on grain structure, micrographs 604 and 609
- Steels: equiaxed and deformed grains in typical mild steel, micrographs 17 and 201
- Cast iron (spheroidal graphite, SG): used in car engine blocks, micrograph 64

3. Materials Software: Materials selection and processing

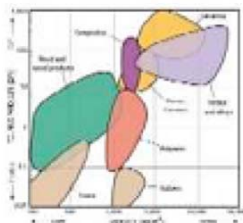
3.1 www-materials.eng.cam.ac.uk/mpsite/

The site has been created as a resource to aid good practice in the selection of materials for product design. It has information on materials, properties, processes, product design and more. There is information specifically presented for those teaching or following courses in:



but the content in each is not limited to these two subjects and it is worthwhile exploring both.

In addition, there is information on:



Materials information



Material properties



Manufacturing processes



Product design

Among other approaches used, the concept of selection maps are introduced and these are extremely useful (hence strongly recommended) to aid understanding the relationships between different families of materials, e.g. metals, polymers, ceramics. An overview is provided within the above site at www-materials.eng.cam.ac.uk/mpsite/physics/overview/default.html

There is an excellent introduction to materials selection generally, and to materials selection maps in particular, in the two text books written by the originator of the approach:

Materials Selection in Mechanical Design (3rd edition)

M.F. Ashby, published by Butterworth Heinemann, 2005, (Flexicover).

Price: £25 plus shipping

Materials: Engineering, Science, Processing and Design

Michael Ashby, Hugh Shercliff, David Cebon

published by Butterworth Heinemann, 2007, ISBN:0750683910

Price: £29.99 plus shipping

3.2 www.grantadesign.com/education/

More comprehensive materials selection software *CES EduPack 2009* now is available for purchase through Granta Design www.grantadesign.com/solutions/education/ This has options which include parameters that can give perspective on energy conservation issues in the selection of materials.

3.3 MATTER software and associated packages

www.matter.org.uk/universities.htm

MATTER was originally set up to produce computer-based learning software for undergraduate materials science and engineering. Materials Science on CD-ROM has the following topics:

- Introduction to crystallography
- Introduction to electrons in crystals
- Introduction to point defects
- Dislocations
- Introduction to phase diagrams
- Thermodynamics of phase diagrams
- Atomic diffusion in metals and alloys
- Nucleation in metals and alloys
- Introduction to electron microscopes
- Image fundamentals
- Beam-specimen interactions
- Using the SEM
- Aluminium Alloys: Systems
- Aluminium Alloys: Strengthening
- Aluminium Alloys: Processing
- Mechanics of composite materials
- Deformation of Polymers
- Rubber Elasticity
- Glossary

Links to the following sites also can be found at the above Matter site.

www.steeluniversity.org is being developed in partnership with the International Iron and Steel Institute to provide a comprehensive package of informative, advanced and highly interactive e-learning resources on steel technologies, covering all aspects of the steelmaking processes through to products, their applications and recycling. Modules currently available include Secondary Steelmaking, Steel Selection for Car Door Panels and Steels in Construction.

www.aluminium.matter.org.uk An interactive site on aluminium science and technology, developed in partnership with the European Aluminium Association. The first module "Strengthening Mechanisms in Aluminium Alloys" is complete. Two further modules: "Softening Mechanisms" and "Anisotropy" are due for release shortly.

www.aluminium.matter.org.uk/aluselect is a computer-based reference database containing technical information on the most widely used aluminium alloys, developed in partnership with the European Aluminium Association. The web-site presents information about the mechanical, physical and chemical properties of aluminium alloys. At present, 35 wrought alloys and 12 casting alloys are indexed.

www.matter.org.uk/steelmatter Designing with steels has been produced in partnership with Corus and the University of Birmingham. It illustrates the close interdependencies between the different stages of steel production and shows how final properties can be controlled through composition, processing and microstructure.

www.matter.org.uk/tem This set of resources has been designed to accompany an introductory course on transmission electron microscopy. The level is appropriate for students with an understanding of some elementary physics.

www.matter.org.uk/stereography/default.htm This package allows the drawing of stereographic projections for different crystal types using different poles for the projection axis.

www.matter.org.uk/diffraction The site provides an introduction to diffraction; the geometry of diffraction; intensity of diffraction; X-ray diffraction; electron diffraction.

www.matter.org.uk/solidification Provides information on solidification: kinetics; redistribution of solute; cell, dendrite and grain structures; eutectic solidification.