Welcome to Materials 1M03 (2014)



Liquid crystal visualised
under polarized light.

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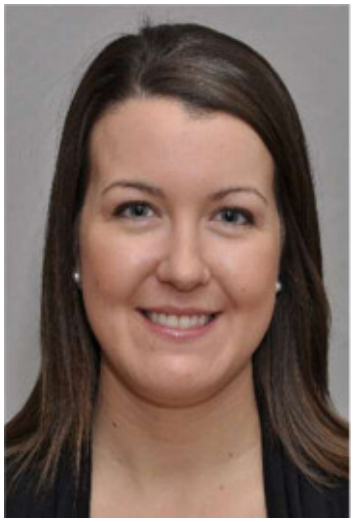
Instructional Team



Dr. Hatem Zurob
C02, C03
JHE-213
Course Coordinator



Dr. Jeff Hoyt
C01, C04
JHE-357



Dr. Kathryn Grandfield
C05
ETB-403

Email: prof1m03@mcmaster.ca

Emails to our avenue accounts will be forwarded to the above address

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Why Do We Study Materials Engineering?

- Everything is made of something
- Materials carry functionality
  - Strength, ductility, electrical or thermal conductivity, etc.
- Engineers integrate Materials with design
- Materials altered by time, environment
- Materials represent an enabling technology
- "Engineering is the art of arranging the materials and forces of nature"

Henry Petroski

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The Age of Materials

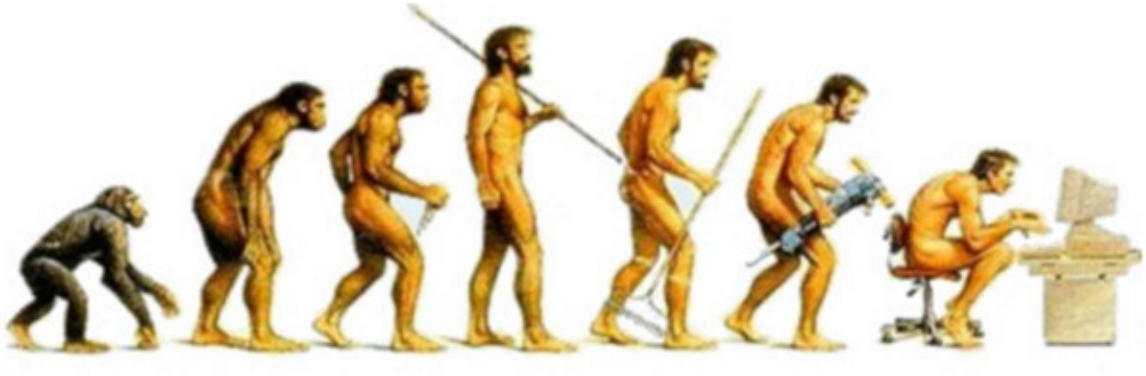
- Stone age ~ 2 mya
- Bronze age ~ 3000 BC
- Iron age ~ 1200 BC

  "Concrete age" 200 BC

  "Steel age" 1850

  Silicon Age 1950

  Nanotech age? 1989 (IBM atom logo)

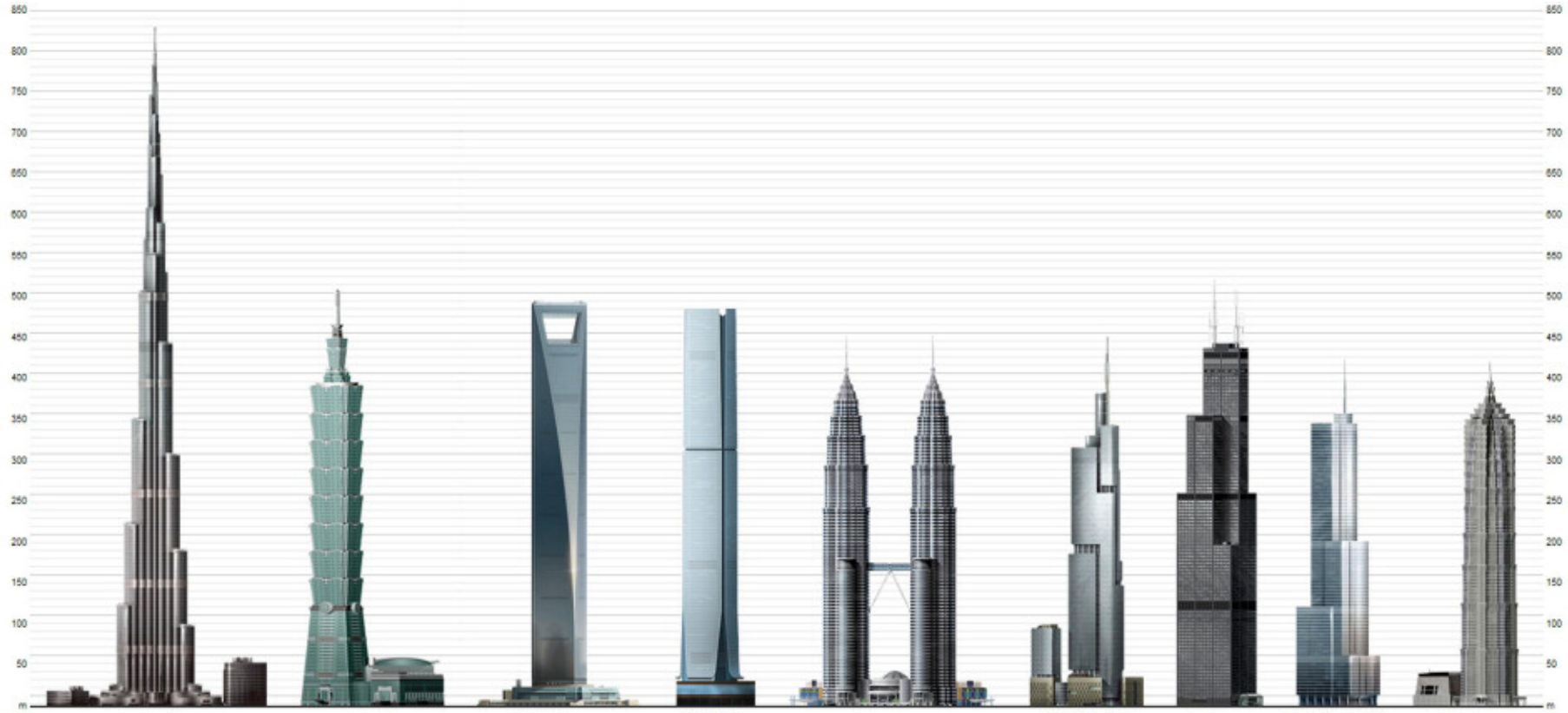


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Civil Engineering

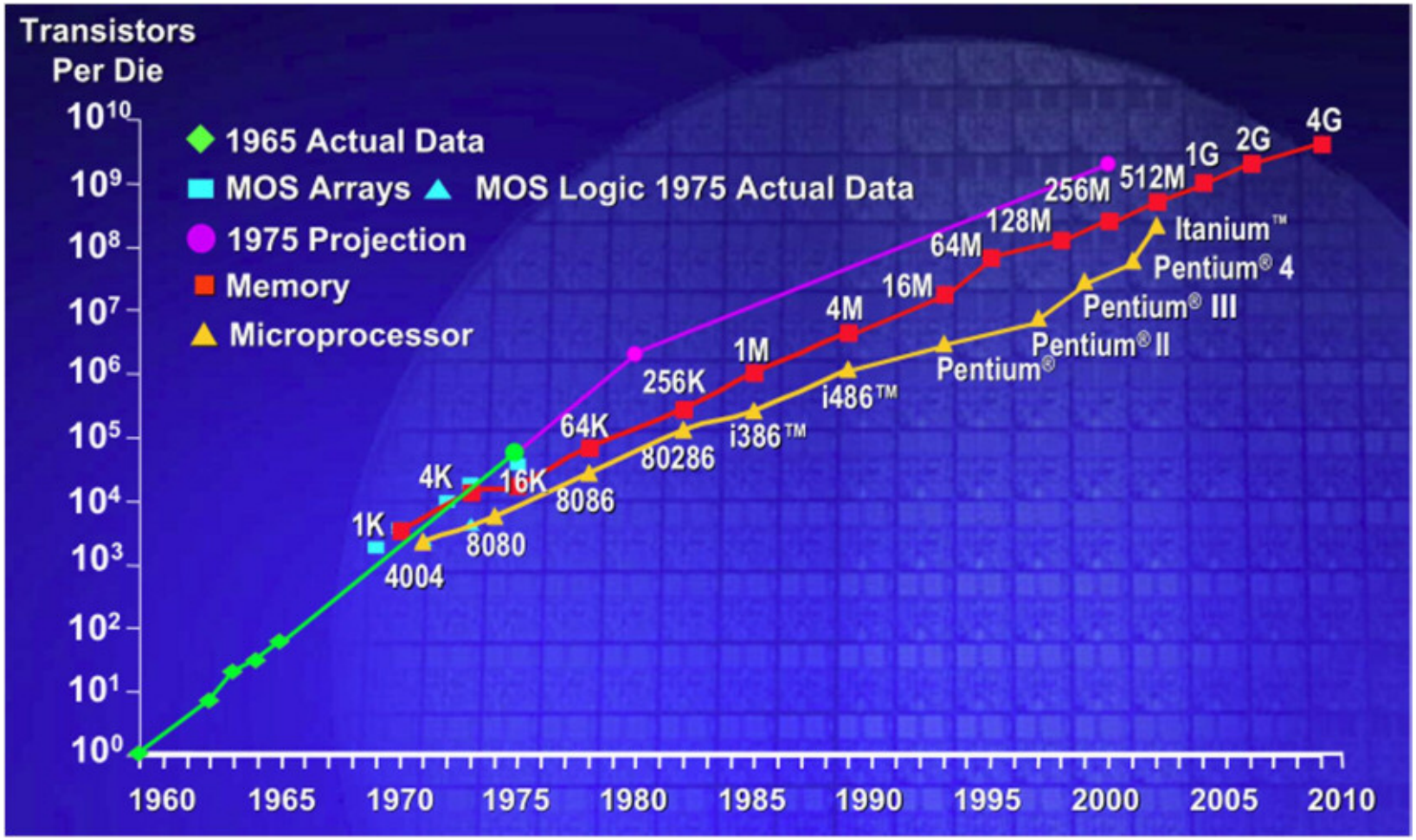


Civil Engineering



Name	Burj Khalifa	Taipei 101	Shanghai World Financial Center	International Commerce Center	Petronas Towers	Nanjing Greenland Financial Complex	Willis Tower	Trump International Hotel & Tower	Jin Mao Tower
City	Dubai	Taipei	Shanghai SH	Hong Kong HK	Kuala Lumpur	Nanjing JS	Chicago IL	Chicago IL	Shanghai SH
Country	United Arab Emirates	Taiwan	China	China	Malaysia	China	United States	United States	China
Illustrator	J. Eduardo Segundo Hernandez	Someformofhuman	Ka777	Mike K.	Cliff Tan	J. Eduardo Segundo Hernandez	Someformofhuman	J. Eduardo Segundo Hernandez	Cliff Tan
Status	Built	Built	Built	Built	Built	Built	Built	Built	Built
Built	2010	2004	2008	2010	1998	2010	1974	2009	1998
Floors	163	101	101	108	88	89	108	98	93
Use	Mixed use	Office	Mixed use	Mixed use	Office	Mixed use	Office	Mixed use	Mixed use
Antenna							527.3 m		
Spire	828 m	508 m			451.9 m	450 m		423.4 m	420.5 m
Roof		448 m	492 m	484 m		381 m	442.1 m	356.9 m	

Electrical & Computer Engineering



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IBM, Intel make major chip breakthrough

Last Updated: Monday, January 29, 2007 | 8:22 AM ET
The Associated Press

In duelling announcements, Intel Corp. and International Business Machines Corp. separately say they have solved a puzzle perplexing the semiconductor industry about how to reduce energy loss in microchip transistors as the technology shrinks to the atomic scale.

Each company said it has devised a way to replace problematic but vital materials in the transistors of computer chips that have begun leaking too much electric current as the circuitry on those chips gets smaller.

Technology experts said it's the most dramatic overhaul of transistor technology for computer chips since the 1960s and is crucial in allowing semiconductor companies to continue making ever-smaller devices that are also energy-efficient.



Gordon Moore, the legendary Intel Corp. co-founder, is shown on May 24, 2001 in Santa Clara, Calif.

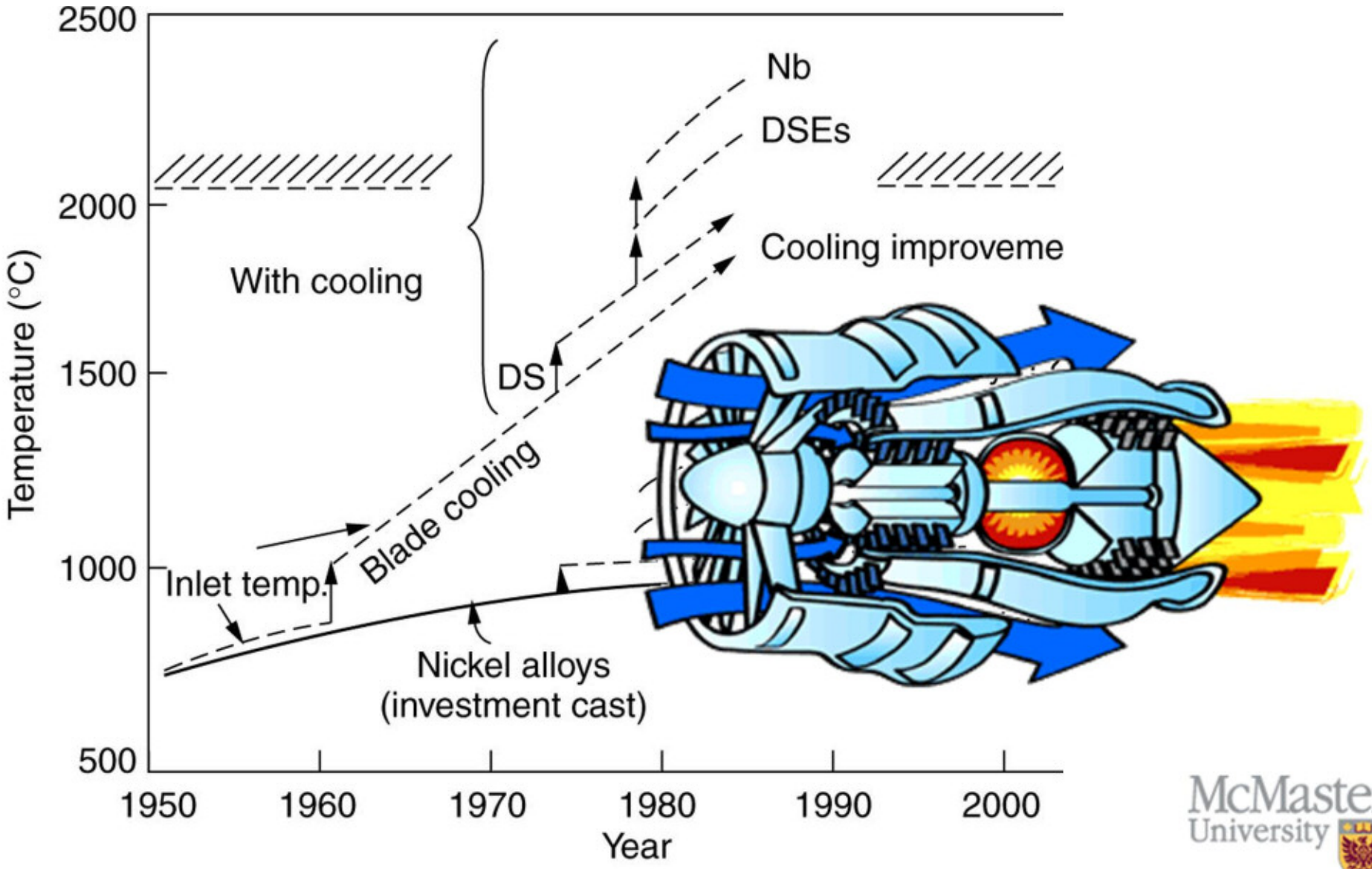
Silicon dioxide replacement

The problem is that the silicon dioxide used for more than 40 years as an insulator inside transistors has been shaved so thin that an increasing amount of current is seeping through, wasting electricity and generating unnecessary heat.

Intel and IBM said they have discovered a way to replace that material with various metals in parts called the gate, which turns the transistor on and off, and the gate dielectric, an insulating layer, which helps improve transistor performance and retain more energy.

University

Mechanical Engineering



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Mechanical Engineering

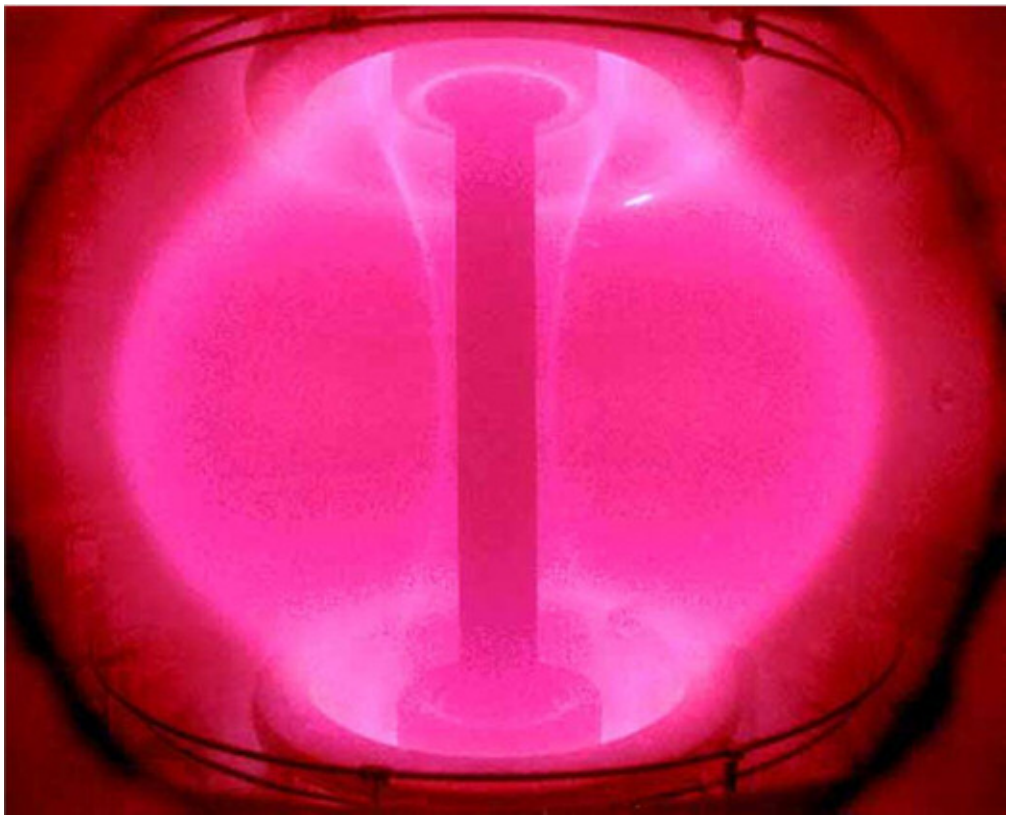


50% of the steels used in an automobile today, did net exist 10 years ago!

Lower emissions necessitate higher strength, lighter materials.

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Engineering Physics



Development of next generation of nuclear reactors requires new materials that can resist radiation damage.

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Chemical Engineering



- Heat resistant materials
- Chemical resistant materials
- Bio-compatible materials.

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Course Objectives

- By the end of this course you should understand:
  - The main classes of materials and what distinguishes them
  - The most important properties exhibited by materials
    - The range of properties exhibited by materials
    - The basis for materials selection based on properties
    - How materials selection integrates with engineering design
- To get to this understanding you need these fundamentals:
  - The underlying structure of solids from the atomic to the macroscopic scale
  - The nature of defects and microstructure in materials
  - The mechanical properties of each class of materials
  - The functional properties of each class of materials
  - How properties depend on materials structure:
    - Bonding and crystal structure
    - Crystalline defects
    - Microstructure / macrostructure

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Lecture Times & Locations

- There are five lecture section.

- Changing lecture section
  - Same material is being taught in all sections
  - If you are not able to attend your assigned section, contact Ms. Danielle Marcellin in JHE 357 to request a change.

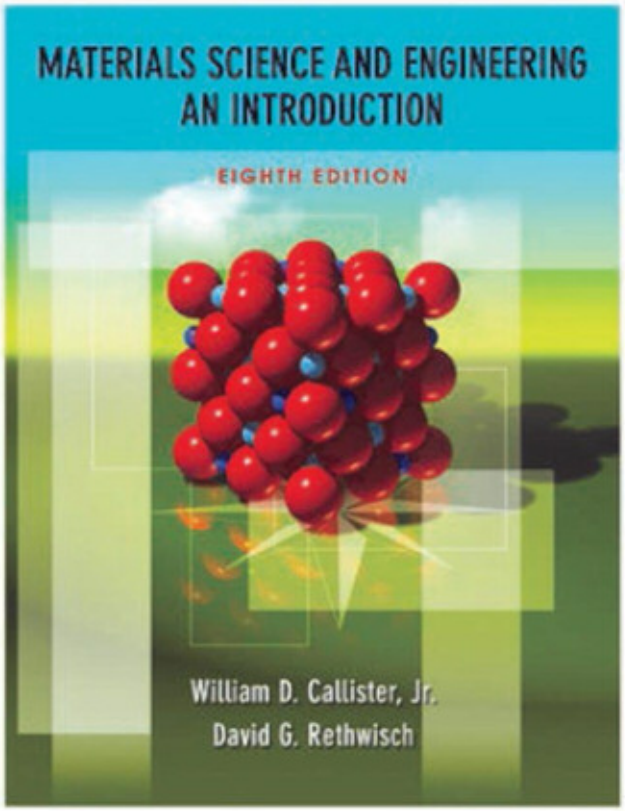
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Getting Help Outside the Class

- **We are here to help:**
  - **Office hours: JHE 352, weekdays from 1:30 to 3:30 (Starting Jan. 13th).**
  - **By email** prof1m03@mcmaster.ca
  - **In addition, all of us would be happy to meet with you at any other time. Please call or email to arrange an appointment.**

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Textbook



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Materials Science and Engineering: An Introduction

Eighth Edition

McMaster University

Available Formats

HARDCOVER FULL TEXT

ISBN: 9780470419977
Price: $159.95

PAPERBACK BLACK AND WHITE FULL TEXT

ISBN: 9781119936114
Price: $83.95
You Save: $76.00

E-TEXT VERSION

ISBN: 9780470563793
Price: $59.50
You Save: $100.45

Building on the success of previous editions, this book continues to provide engineers with a strong understanding of the three primary types of materials and composites, as well as the relationships that exist between the structural elements of materials and their properties. The relationships among processing, structure, properties, and performance components for steels, glass-ceramics, polymer fibers, and silicon semiconductors are explored throughout the chapters. The discussion of the construction of crystallographic directions in hexagonal unit cells is expanded. At the end of each chapter, engineers will also find revised summaries and new equation summaries to reexamine key concepts.

WILEY

University

Electronic Resources

- Avenue
  - http://avenue.mcmaster.ca/
    - Account set up for each registered student
    - Username = MACID
    - Password = MACID Password
  - The MTLS 1M03 Avenue site contains
    - Course outline – read this
      - You are responsible for knowing what is in it
    - Lecture notes (pdf format)
    - Notice board for course announcements
    - Calendar with critical dates – due dates, tests, etc.
    - Web-based homework system
    - Practice questions and old tests/exams.

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Web-based Homework Assignments

- All homework assignments completed on-line via Avenue
- Can work on assignments / quizzes
  - As long as you want (up to the due date)
  - Save and return
- Each student gets a different assignment randomly selected from a database
- Can do each assignment 3 times, the highest mark will be kept
  - Feedback is available after assignment is submitted
- Assignments are due Monday at 5pm. There is a 12-hr grace period; absolute deadline: 5 am Tuesday.

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Tests and Exam

- Two term tests
  - Test #1: Tuesday, February 4, 2014
  - Test #2: Tuesday, March 4, 2014
  - Time
    - 7:00PM-8:00PM (regular time)
  - Please let us know about conflicts/special arrangements at least two weeks in advance.
- Final exam (3 hours) covers entire term. Scheduled by registrar's office
- On exam and tests
  - *One (1), double-sided* page crib sheet allowed (8-1/2 x 11")
  - Casio fx 991 calculator only.

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Method of Assessment

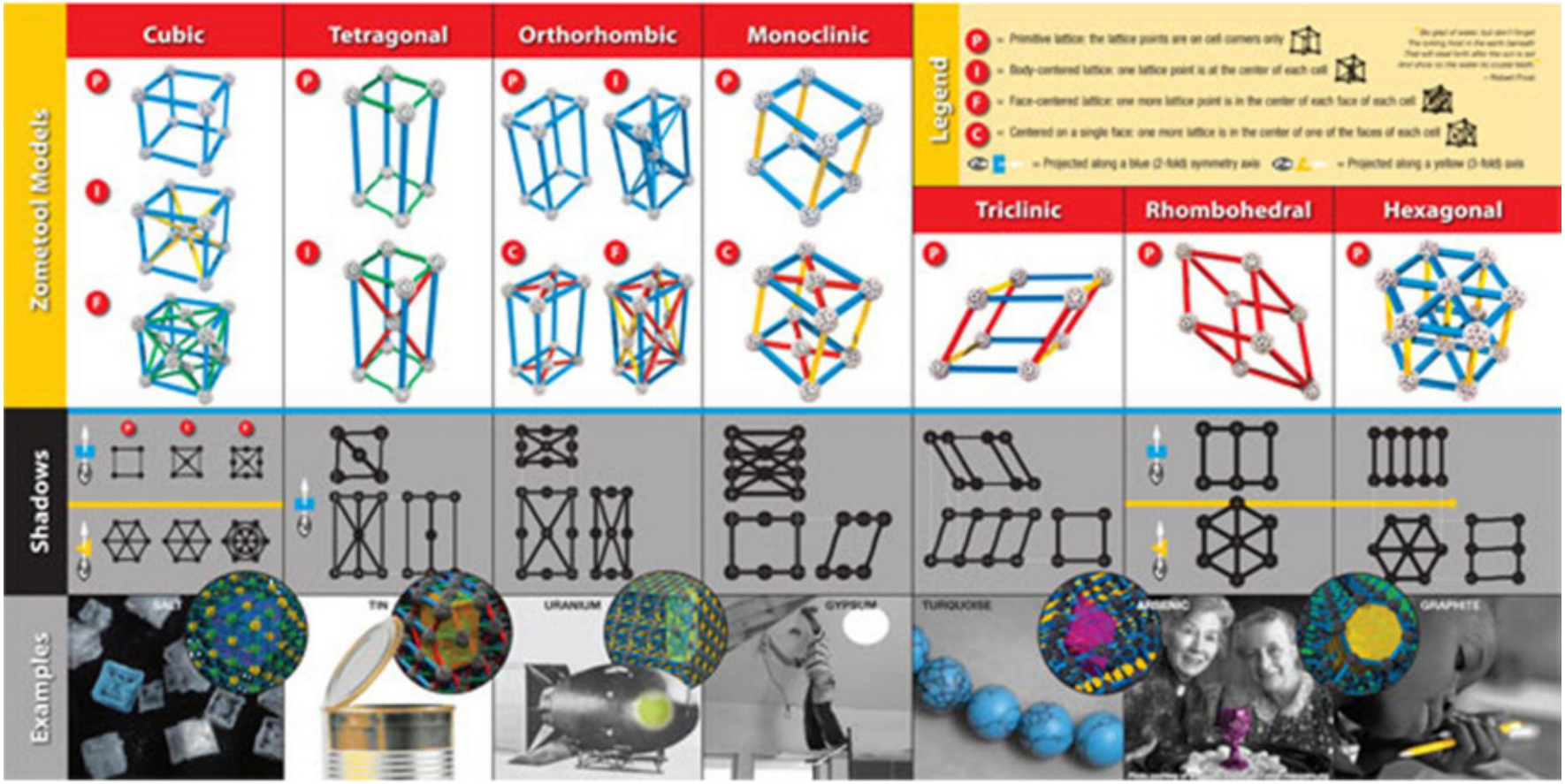
- **Five homework assignments (Avenue) 20%**
- **Two mid-term tests 30%**
- **Final exam 50%**

- ***In addition, there are two optional EPIC labs. You'll earn 2.5% bonus for each lab you complete.***

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EPIC Labs

http://epiclab.mcmaster.ca



Lab 1: Exploring Crystal Structures with Zometool kits (1 hr)

Jan 13 to 31 in ETB 126 from 2:30 to 5:30 everyday.

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EPIC Labs

http://epiclab.mcmaster.ca



Lab 2: Temperature Measurement (1 hr)

March 10 to 28 in ETB 126 from 2:30 to 5:30 everyday.

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Summary

- **Study of materials involves understanding**
  - That design requires selection of materials based on their properties
  - That properties of a material depend on its structure
  - That materials exhibit a wide range of properties
  - That material properties vary over a wide range
  - How all this fits together

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