

Material Processing and Characterization

MLP 704

Team

Krishna Balasubramanian

- Assistant Professor, Department of Material Science and Engineering
- Webpage:
<https://web.iitd.ac.in/~bkrishna>
- Email: bkrishna@mse.iitd.ac.in
- Ph: 01126548559

Teaching Assistants: (11)

Arun Sehrawat, Pratip Sankar Banerjee	Saransh Tanwar, Harshita Durgapal	YASH PRAKASH TONDARE, PARTH BIDALIYA, Kriti Shakya, VISHAL KUMAR	Devesh Kumar
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About the course

- Graduate level course on material processing and characterization techniques.
- Introduce the concept of material selection, processing and characterization
- The measurement techniques will involve several fundamental physical properties which every engineer, particular a materials engineer should master.
- The course has **1 hours of lecture, 1 tutorial and 4 hours** of lab session per week and has a massive **4** credits.

Content

Sno	Topic	Date	Week
1	Introduction		1
2	conventional material processing		2
3	Rolling, Polishing, cutting		3
4	Optical Microscope		4
5	SEM		5
6	Mechanical Behavior (hardness)		6
7	AFM		7
8	Solvo-thermal		8
9	XRD		9
10	FTIR		10
11	Raman		11
12	Sputtering		12
13	PLD		13
14	Buffer		14

Course Information

Course Timing:

- Lectures
Slot X, **Tuesdays 10 – 11 AM ?**
- Labs:
Thursday 2 – 6 PM. All students will need to assemble in the lab hall (to be decided)

Prerequisites:

- Undergraduate level Math, Physics and Materials Science
- Inquisitiveness to learn!

Lecture Hosting

- Lecture delivery:
 - All sessions in-person
 - Attendance will be recorded. In fact participation in lectures is mandatory.
- Homework to be submitted before the class sessions. Could involve simple coding exercising.
 - Submissions are binary: either you submit before time or leave without marks.
- All exams and evaluation will be offline. The answer sheets will be evaluated by TA assigned.
- Dishonesty will be very seriously dealt with. We are a team of very experienced professionals. So, any malpractice will be identified, and the student will be given a 'F'. Remember, this is much worse than just dropping the course!

Lab Hosting

- Experiments will happen at different places in the department/Institute
- A lab file is to be maintained by all. Each lab you will bring the file with sheets.
- In lab session,
 - We will start with an introductory briefing by a faculty member
 - A question list will be provided which needs answering
 - We will divide you ppl into sufficiently small groups and each group will be independently taken for experiments.
 - The group will return back and complete the lab sheet.
 - The lab sheets are individual exercises. They are to be treated as exam papers and filled individually.
 - You are to bring several A4 sheets, graph papers, stapler, calculator and necessary stationaries.
 - No one is allowed to leave before 5 PM.
 - The sheets are expected to be completed on the same day and submitted to the TA. It will not be collected later on.
 - After evaluation, the sheets will be returned back and it needs to be filed.
 - A final viva-voce will be conducted on the last day of the course and your lab file be collected for evaluation.

References

- Multiple references for each topic. Will be announced during the lecture time. General references are as follows:
- Processing: Michael Ashby, Material Selection in Mechanical Design, Elsevier, 2005
- Pavia, Lapman and Kris, Introduction to spectroscopy, Brooks Cole 2000
- B. D. Cullity and S. R. Stock, Elements of X-ray Diffraction, Prentice Hall; 3 ed. 2001R
- J. Goldstein, Scanning electron microscopy and X-Ray Microanalysis
- R. Haynes, Optical Microscopy of Materials, Springer, 1984
- Michael E. Brown and Patrick K. Gallagher, Handbook of Thermal Analysis and Calorimetry, Elsevier, 2003.
- Peter J. Haines, Thermal methods of Analysis, Principles, Applications and Problems, Springer

Evaluation policy

Evaluation:

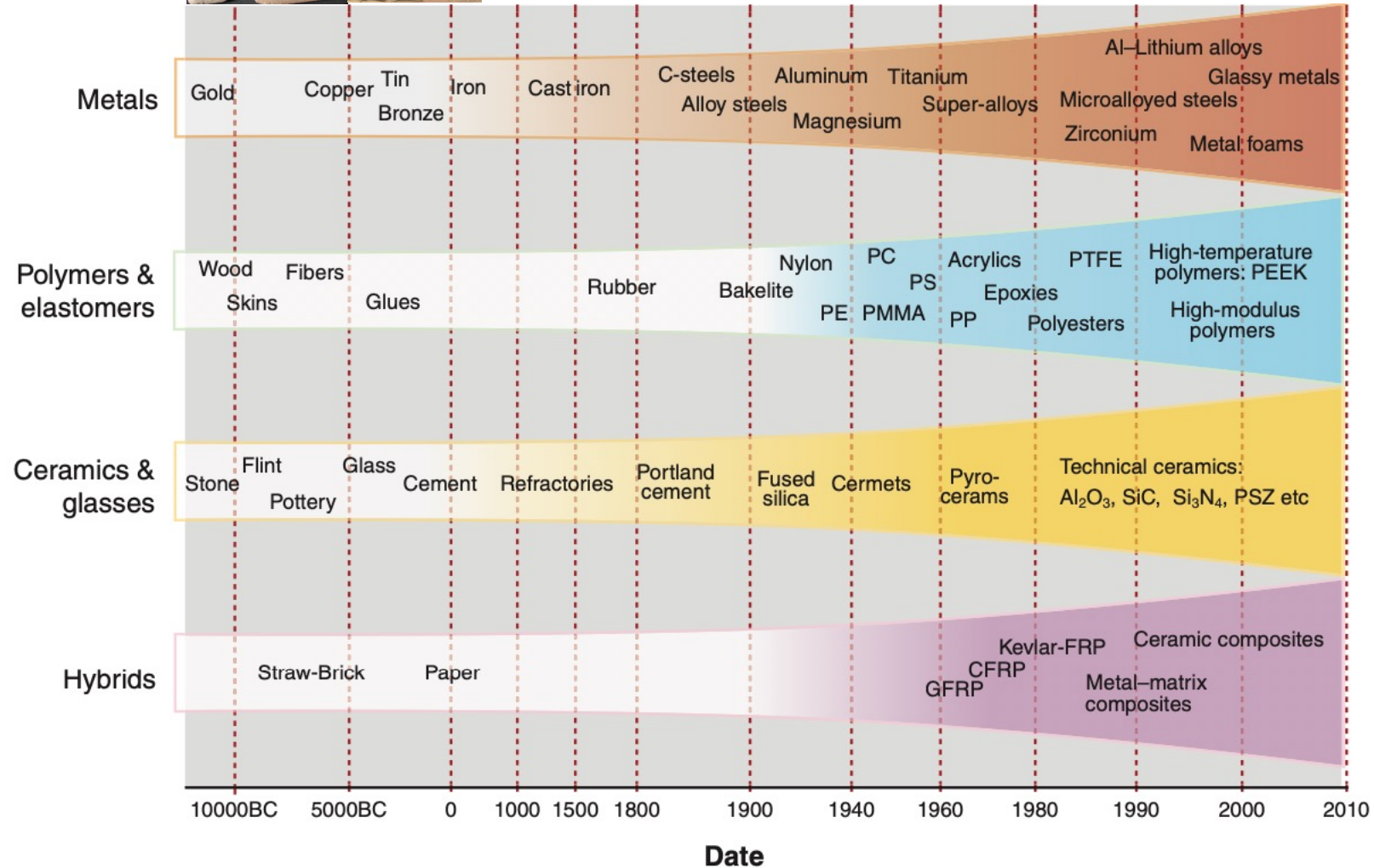
- Relatively graded course with the following split up:
- 25 % Minor, 35% Major, Quiz 10%, 20% Lab sheets, attendance 10%
- **Audit Pass is 35%**

Academic Honesty

All students registering to this course voluntarily commit to the academic integrity, research and Ethics policy, IIT Delhi (https://academics.iitd.ac.in/sites/default/files/registration/forms/10_FORM%20H.pdf). This is an under-graduate level course in the country's most premier institute, and I expect the students to know their responsibility. If any document submitted to us is plagiarized (copied verbatim either from textbook/ online resources/ fellow students...), the student will be deregistered and promptly handed to institute authorities.

Discussion is okay for homework, but the submission needs to reflect the student's work. No discussion/references are allowed in lab sheets, quizzes/minors/final exams.

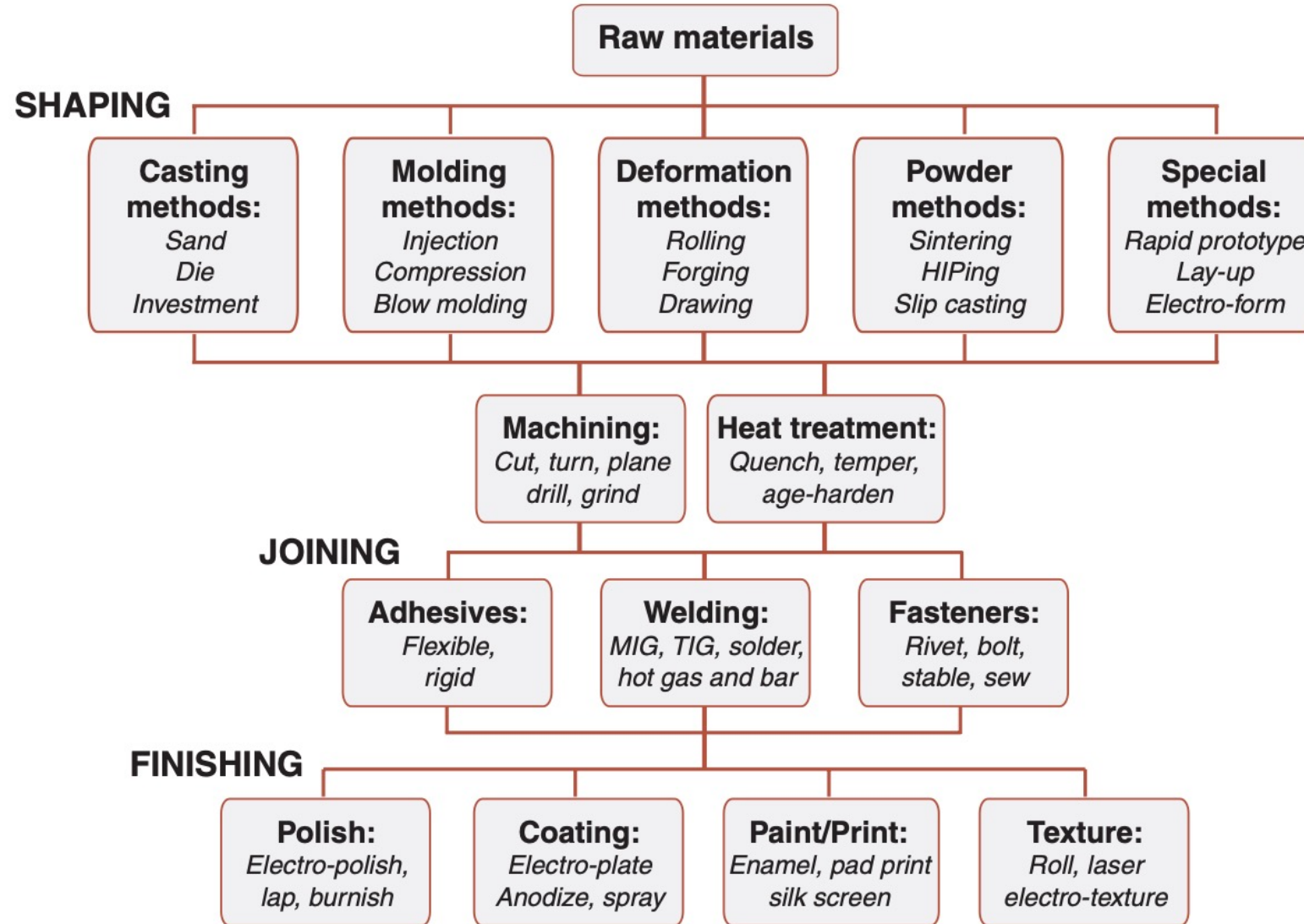
Kizhadi, TN



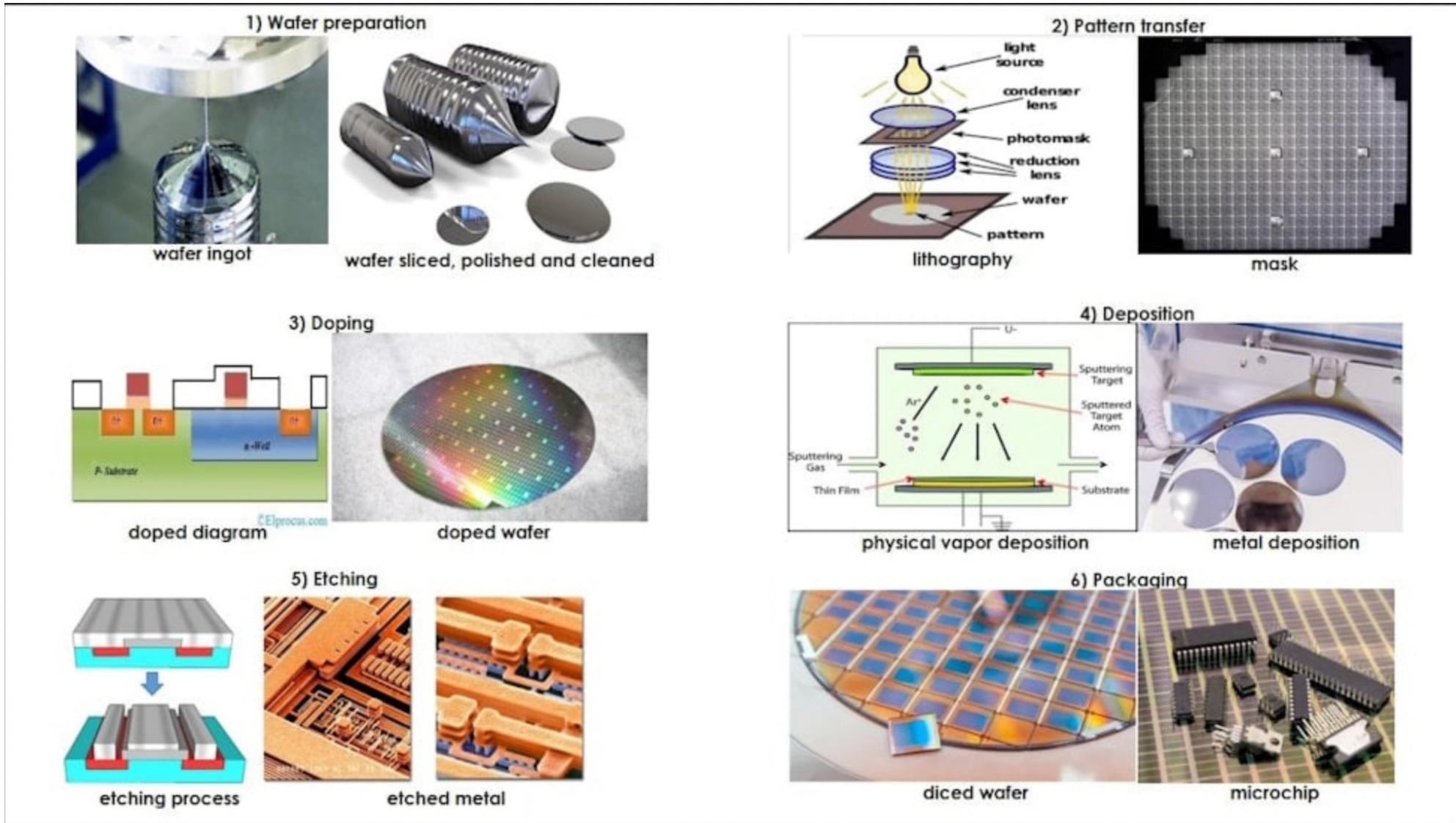
Often quoted manufacturing hallmark



Processing in Conventional Materials



Typical Semiconductor Work Flow



Engineering Materials Menu Card

- General property list:

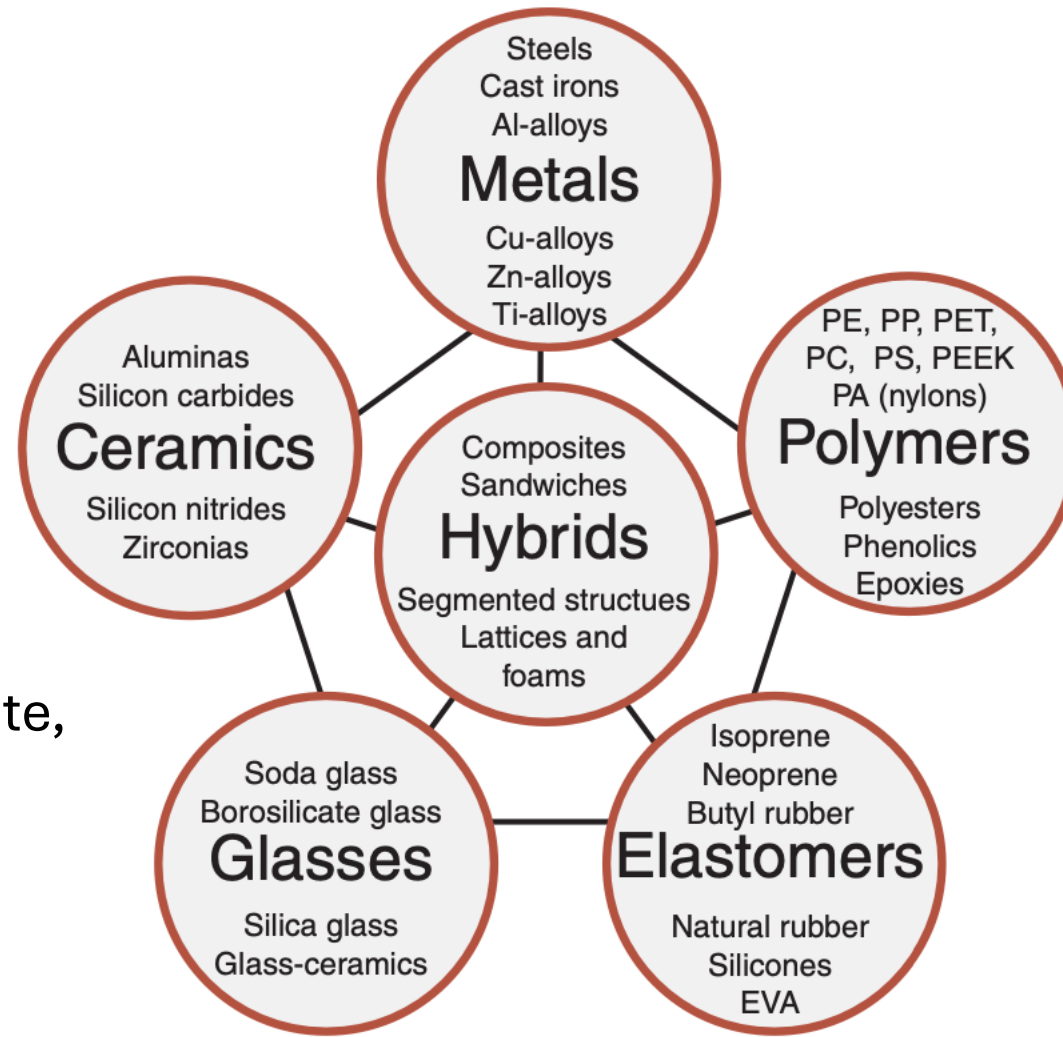
- density
- Price

- Mechanical

- Moduli,
- Strengths (Yield, ultimate, failure,...)
- Toughness

- Thermal

- Conductivity
- Specific heat
- Expansion coefficient



- Electrical

- Resistivity
- Dielectric breakdown
- Dielectric constant

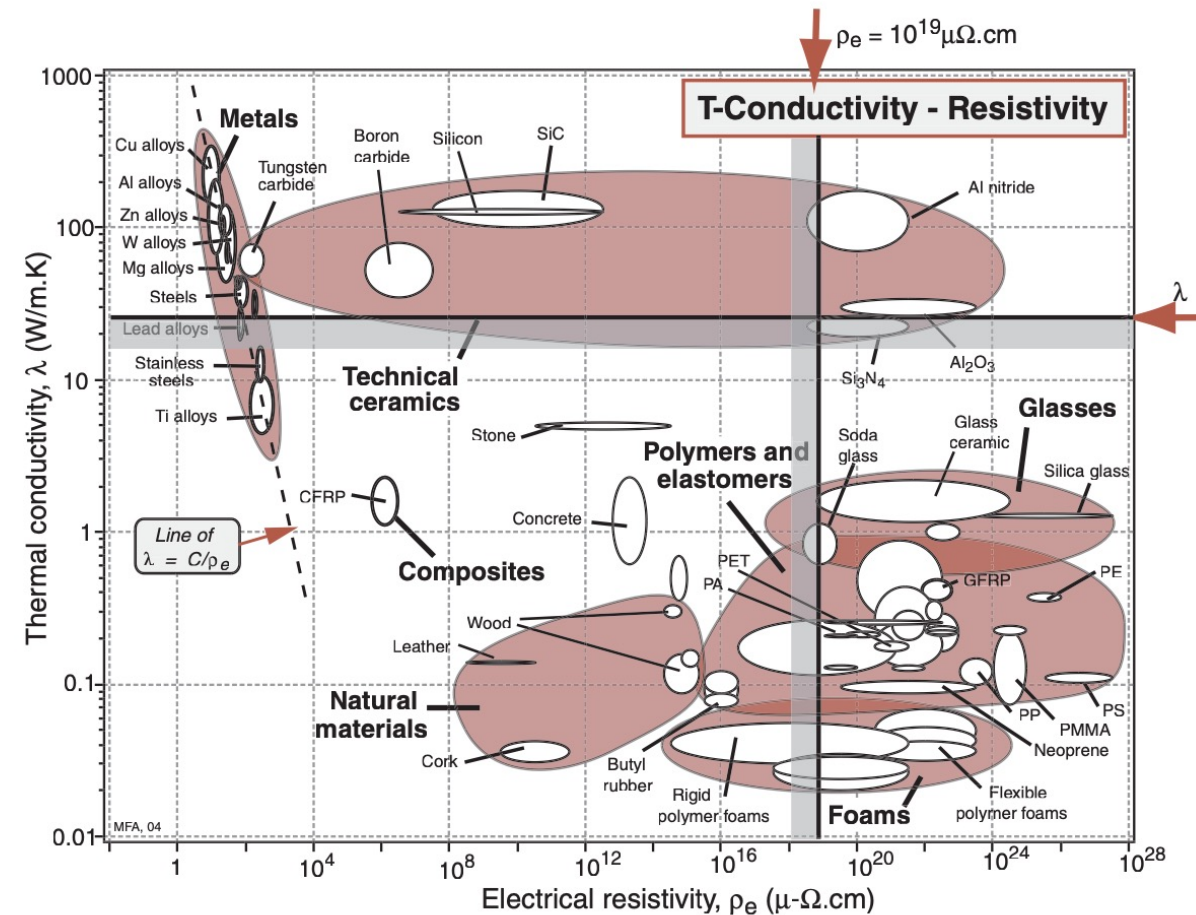
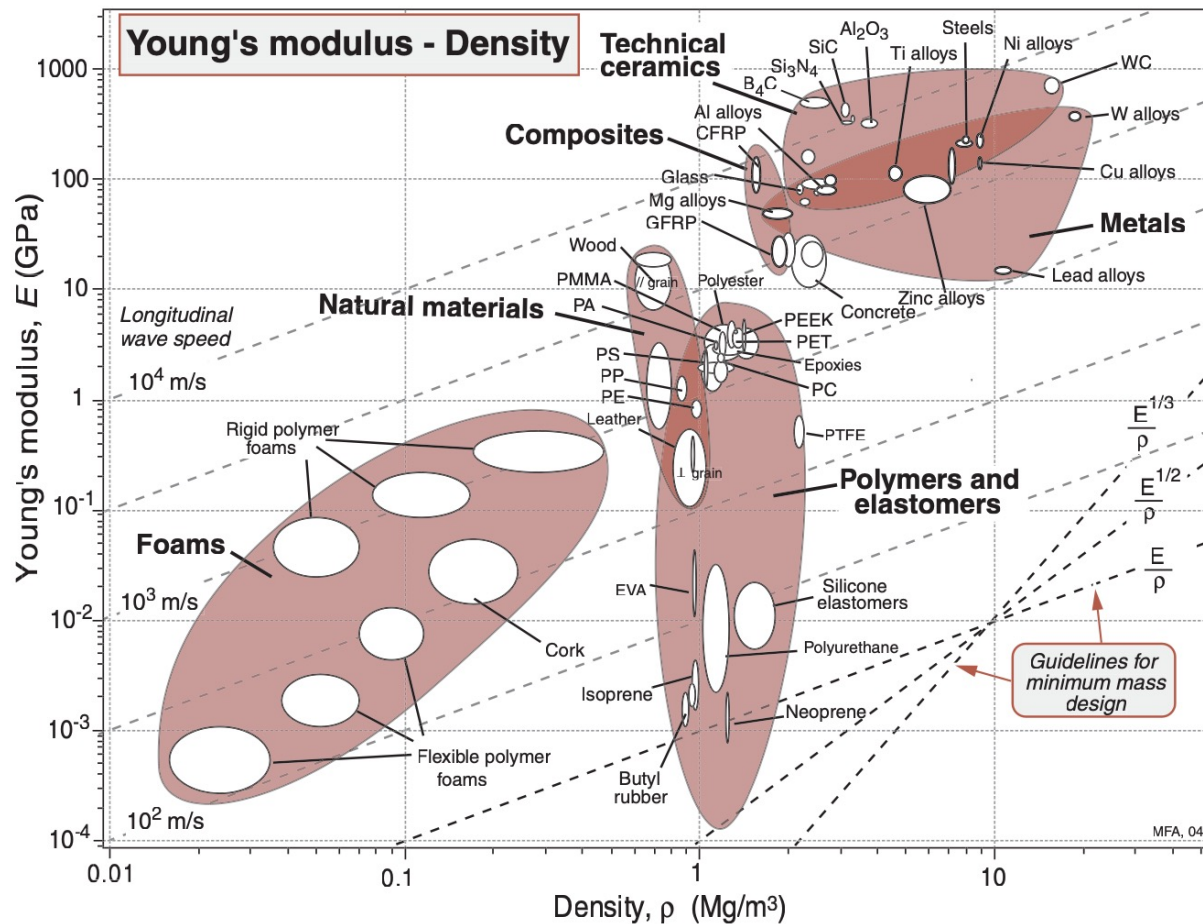
- Optical

- Transparency
- Refractive Index

- Environmental

- Corrosion resistance
- Resistance to harsh environments

Known trade-offs



First Process: Solidification from Melts