

Lecture 6



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2. Strength-Density

Metal and Polymers: Yield Strength
Ceramics and Glasses: Compressive Strength
Strength Elastomers: Tensile Tear Strength
Composites: Tensile Failure

MEAS-91

Engineering Ceramics

Glasses

Si-C-Diamond
 SiN
 SiC
 SiAlON
 Al₂O₃
 ZnO
 ZnS
 MgO
 SiO₂

Engineering Alloys

Cast Irons

Stainless Steels

Al Alloys

Rock Alloys

Storage Alloys

Al Alloys

Cast Irons

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Storage Alloys

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Cast Irons

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Engineering Composites

Laminates

Aluminum

Carbon Fiber

Kevlar

Fiberglass

Basalt

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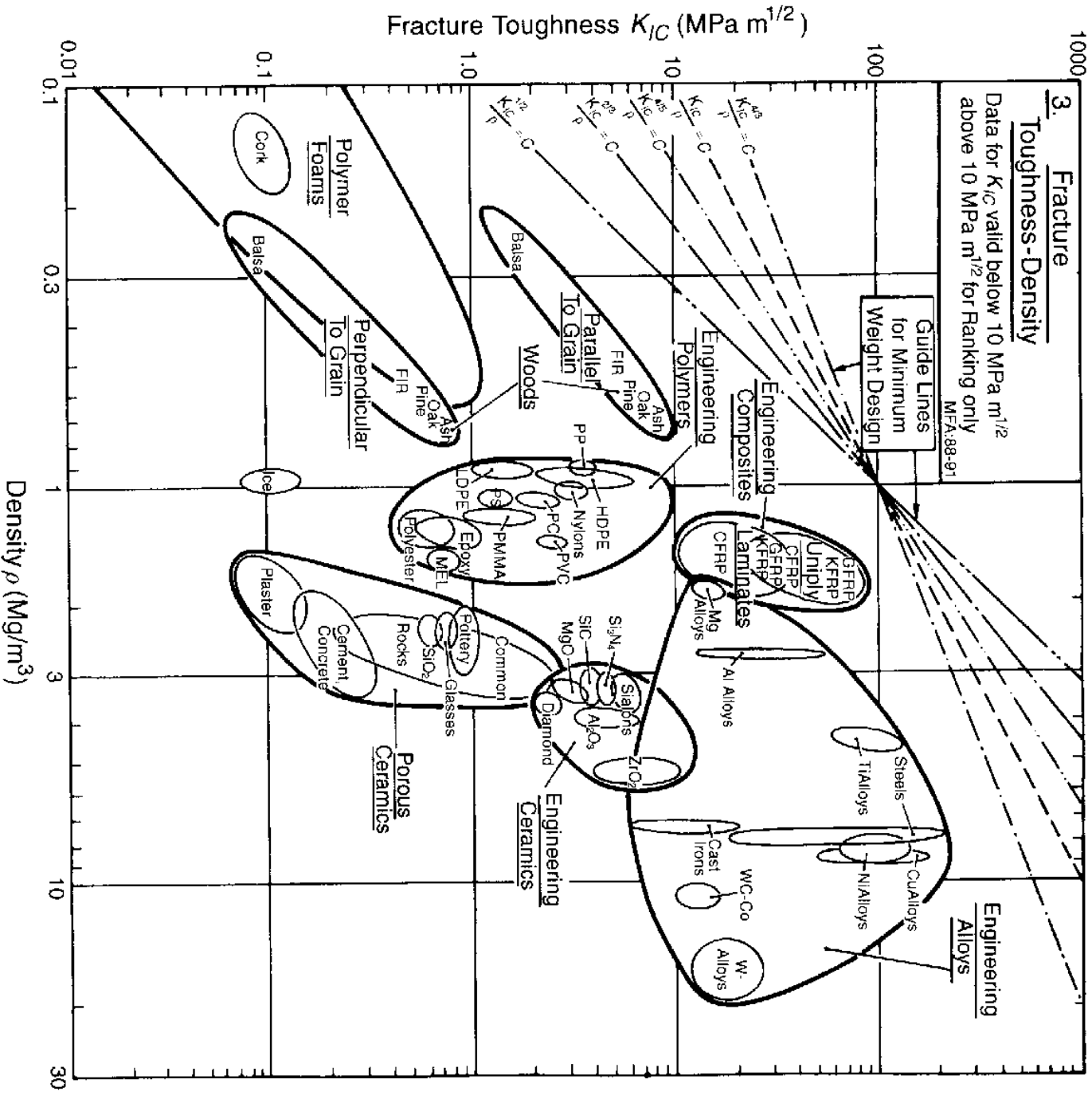
Carbon Fiber

3. Fracture Toughness-Density

Data for K_{Ic} valid below 10 MPa $m^{1/2}$ above 10 MPa $m^{1/2}$ for Ranking only

MFA:98-91

Guide Lines for Minimum Weight Design



An Additional Material Value



- Sustainability
- Materials utilization increased by a factor of 2 since 1960
- Limits to productivity if 1-time through model is retained
- In order to retain standard of living need strategies for remanufacturing and material recovery

For Larger Projects



- Will consider material recovery as a part of the production strategy
- Volume/efficiency of material use will be considered as a general aspect of design

Additional References



- On reserve in library and electronic reserve:
- *Mind over matter -- recasting the role of materials in our lives* by Gardner and Sampat, Worldwatch Paper 144, December 1998.