Introduction to Biomaterials

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LEC (2)

Polymeric Biomaterials: Adv & Disadv

- Easy to make complicated items
- Tailorable physical & mechanical properties
- Surface modification
- Immobilize cell etc.
- Biodegradable

- Leachable compounds
- Absorb water & proteins etc.
- Surface contamination
- Wear & breakdown
- Biodegradation
- Difficult to sterilize

Polymerization

- Condensation: A reaction occurs between two molecules to form a larger molecule with the elimination of a smaller molecule.
- Addition: A reaction occurs between two molecules to form a larger molecule without the elimination of a smaller molecule.

Polymeric Biomaterials

- PMMA
- PVC
- PLA/PGA
- PE
- PP
- PA
- PTFE
- PET
- PUR
- Silicones

Bioceramic: Advantages and disadvantage

- High compression strength
- Wear & corrosion resistance
- Can be highly polished
- Bioactive/inert

- High modulus (mismatched with bone)
- Low strength in tension
- Low fracture toughness
- Difficult to fabricate

Bioceramics

- Alumina
- Zirconia (partially stabilized)
- Silicate glass
- Calcium phosphate (apatite)
- Calcium carbonate

Metallic Biomaterials:Advantages & Disadvantages

- High strength
- Fatigue resistance
- Wear resistance
- Easy fabrication
- Easy to sterilize
- Shape memory

- High moduls
- Corrosion
- Metal ion sensitivity and toxicity
- Metallic looking

Metallic biomaterials

- Stainless steel (316L)
- Co-Cr alloys
- Ti_6Al_4V
- Au-Ag-Cu-Pd alloys
- Amalgam (AgSnCuZnHg)
- Ni-Ti
- Titanium

Surface modification (treatment)

- Physical and mechanical treatment
- Chemical treatment
- Biological treatment

Surface Properties of Materials

- Contact angle (Hydrophilic & Hydrophobic)
- ESCA & SIMS (surface chemical analysis)
- SEM (Surface morphology)

Deterioration of Biomaterials

- Corrossion
- Degradation
- Calcification
- Mechanical loading
- Combined