BME449 Tissue Engineering

Lecture #3
Scaffolds

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Scaffold Properties
Porosity and Interconnectivity

Porosity Characterization

- Porosimetry:
  - Force gas or liquid into holes, response is average pore size
  - Care must be taken to avoid deformation
- Suitable microscopy may be used image surfaces

Scaffold Properties
Biodegradability

Test Methods

In vitro:

• Under physiological conditions:
pH=7.4, T= 37C , with/without shaking
in NaCl solution or PBS or cell culture medium
• Can performed with the presence of some enzyme
(lipase, collagenase, amylase, etc.

In vivo:

•Preformed by implanting the scaffold in the defect area

Scaffold Properties

Mechanical Properties

Test Methods:

- Depends on the final use.
- Tensile, compressive, torsion, bending testing

Scaffold Properties

THE SURFACE

METHODS:

WET CHEMISTRY IN SURFACE MODIFICATION

- Wet chemical etching
- Oxidation by wet surface modification methods
- Hydrolysis

PHYSICAL METHODS FOR SURFACE ALTERNATIONS

- Plasma activation and modification
- UV-irradiation
- β- and γ-irradiation

GRAFTING

PLASMA MODIFICATION

Plasma reactors are varying in size from 1L to several cubic meters but all of them typically consists of a gaseous inlet and outlet, a reactor vessel, a vacuum pump, and a matching box.

Plasma surface modification methods:

- Plasma sputtering and etching
- Plasma grafting
- Plasma functionalization
- Dual plasma deposition
- Plasma polymerization

Scaffold Properties

THE SURFACE

Characterization Method	Abbr.	Analyzed depth	Resolution	Cost
Contact angle measurements		3-20 Å	1 mm	Moderate
Scanning Tunneling Microscopy	STM	5 Å	1 Å	Expensive
Scanning Electron Microscopy	SEM	5 Å	40 Å	Expensive
X-Ray Photoelectron Spectroscopy	XPS/ ESCA	10-250 Å	10-150 μm	Very expensive
Auger Electron Spectroscopy	AES	50-100 Å	100 Å	Very expensive
Fourier Transform Infrared Spectroscopy - Attenuated Total Reflectance	FTIR-ATR	1-5 μm	10 μm	Expensive
Atomic Force Microscopy	AFM	Different	Very high	Expensive