Fourth lecture

CHARACTERIZATION OF MATERIALS —1

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1.2.c. Friction and wear failure

Wear properties of an implant material are important, especially for various joint replacements. Wear cannot be discussed without some understanding of friction between two materials. When two solid materials contact, they touch only at the tips of their highest asperities (microscopic protuberances). Therefore, the real contact area is much smaller than the apparent surface area. It is found that the true area of contact increases with. applied load (P) for ductile materials. Ductile materials can be pressure welded due to the formation of plastic junctions, the plastic junctions are the main source of an adhesive friction when two materials are sliding over each other with or without a lubricating film.

1.3. Viscoelasticity

1.3.a. Viscoelastic material behavior

Viscoelastic materials are those for which the relationship between stress and strain depends on time. In such materials the stiffness will depend on the rate of application of the load. In addition, mechanical energy is dissipated by conversion to heat in the deformation of viscoelastic materials. All materials exhibit some viscoelastic response. In metals such as steel or aluminum at room temperature, as well as in quartz, the response at small deformation is almost purely clastic, Metals can behave

plastically at large deformation, but ideally plastic deformation is independent of time. Also, plastic deformation occurs only if a threshold stress is exceeded. By contrast, materials such as synthetic polymers, wood, and human tissue display significant viscoelastic effects, and these effects occur at small or large stress.

1.3.b. Characterization of viscoelastic materials

1.3.c. Prediction of the response

1.3.d. Mechanical models

1.3.e. Behavior of viscoelastic materials

1.3.f. Applications