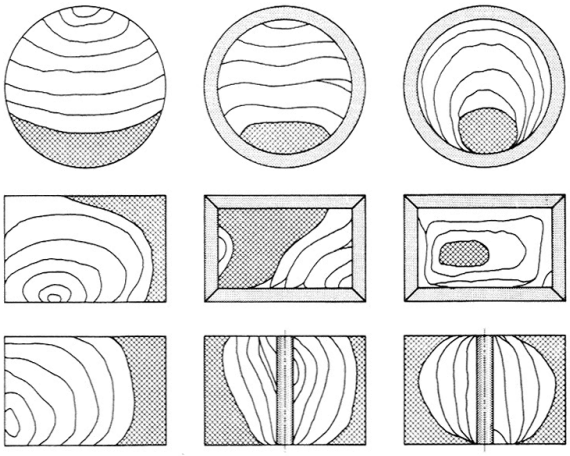

FAILURE ANALYSIS & PREVENTION

engr 3820

homework 6

CASE STUDY READINGS

I have two case study readings for you this week. The first is an investigation of a bicycle shock that includes some force estimations and a range of quantitative analyses. I thought that this article may inspire some ideas on how you may communicate your own qualitative analyses. The second article describes the application of fracture mechanics to food. Check out the use of the Griffith crack theory to the fracture of food during chewing.

- Shelton, H., Sullivan, J.O. and Gall, K., Analysis of the fatigue failure of a mountain bike front shock, *Engineering Failure Analysis* 11 (2004) 375-386.
- Vincent, J., Application of fracture mechanics to the texture of food, *Engineering Failure Analysis* 11 (2004) 695-704.

GRIFFITH CRACK THEORY

Griffith crack theory is one of those failure topics that lecturers love to present. It's so cool. The theory relates the strain energy within a material to the surface energy of a new crack. If you've never seen this before, check out these introductory readings in ASM Handbook:

Volume 19, Fatigue and Fracture -> Fracture Mechanics, Damage Tolerance, and Life Assessment -> An Introduction to Fracture Mechanics ->

- Introduction
- General Fracture Control Concepts
- Linear Elastic Fracture Mechanics

For additional reading on Griffith Crack Theory, I have some lecture notes from an MIT professor on the course web site. See the "Lecture Notes" section of the Resources page of the course web site.

FRACTOGRAPHY

You say you want to learn how to interpret fracture surfaces? By all means, give it a try. Let's start with **brittle** fractures of metals, ceramics and glasses, and polymers.

In AC425, in front of the television, I've placed a collection of materials (metals and alloys, ceramics and glasses, and polymers) that failed in a brittle manner. Grab a sample, and spend some time characterizing it using visual examination, stereo microscopic examination, and scanning electron microscopic examination. Take some photos, and write a paragraph or two that describes what you see. Use the ASM Handbooks for reference photos of brittle fractures in metals, ceramics, and plastics.