

Team Quiz #4 MME 3516 "Failure Analysis" - David Burleigh March 15, 2016

You may use your books and notes. Your signature shows that you agree with the answers. No discussions are allowed between the different teams. Each team returns one signed copy to Prof. Burleigh. Do not go onto a second page.

Name	signature
	Solution

Bolts made from 4340 steel were electro-plated with zinc in order to prevent corrosion. When they were torqued to a stress equal to 100,000 psi (one third of their tensile strength), they all fractured within one day.
100,000 psi = 690 MPa

(Fig 3.77 from Fontana & Greene, 1978)

HE causes a delayed fracture.

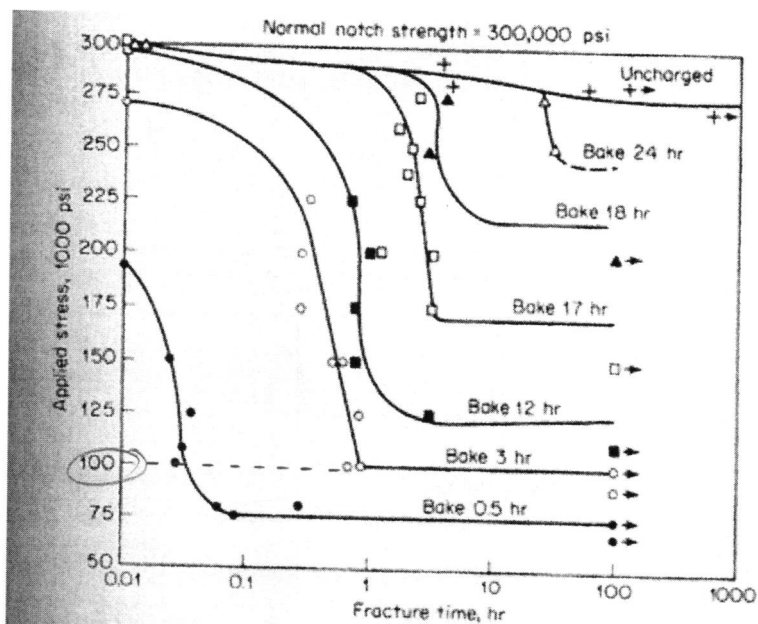
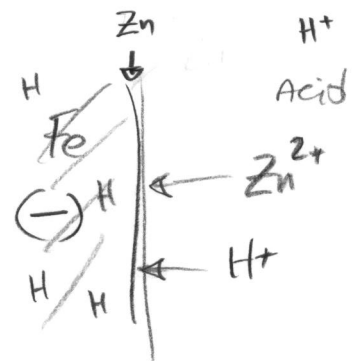


Fig. 3-77. Static fatigue curves for various hydrogen concentrations obtained by baking 4340 steel different times at 300°F.

(a) Why did the bolts break?

HE (Hydrogen embrittlement) from hydrogen absorption during electroplating



(b) What is the remedy to prevent the bolts from breaking?

Bake-Out for longer times.

12 hr minimum, but 24 hr. is better.

You need to be specific, and include a factor of safety.