

Talk Title: Metal Fatigue: The Next Decade

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Date: Monday, March 1, 2010

Time: 4:00 to 5:00

Refreshments: 3:30 to 4:00

Room: Wilsdorf 101

Abstract:

The vision for next-generation prognosis of the fatigue health of high performance metals in aerospace and energy systems requires materials science advances yet to be realized; particularly, damage mechanism-based modeling of fatigue properties and inclusion of the strong role of chemical environment. Scientific opportunities abound across several disciplines and length scales. Research at UVa is centered on aerospace aluminum alloys and includes: (a) prediction of the temperature dependence of fatigue crack growth based on mass transport/reaction-rate limited modeling leading to better life assessment, (b) high resolution characterization of fatigue crack path crystallography (SEM/EBSD) and crack tip dislocation structure (FIB/TEM) leading to a better-informed damage physics model, (c) ionic inhibition of hydrogen uptake at a crack tip leading to smart healing of fatigue and reduced prognosis complexity, and (d) measurement of crack formation and growth from corrosion damage leading to a validated microstructure-scale model of fatigue. The opportunity exists to develop a similar scientific foundation for control of H₂-enhanced fatigue of ferrous alloys in next generation energy systems.

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UIUC Seminar

Title and Sponsors/Collaborators	2 slides	
Prognosis Vision and Opportunities in Metals	9	
Corrosion Degradation of Fatigue	7	(c)
Temperature Dependence and RR Modeling	7	(a)
Crack Tip Damage Probes	13	(b)
Inhibition	1	(d)
Conclusions	1	
	39 slides	

For the UVa talk, I will downplay the MSC work by Burns and focus on the H story moving from water vapor exposure/temperature to crack damage probes to ionic inhibition. I will also downplay some of the introductory slides on prognosis and importance of metals that I pitched at UIUC. I will get into ionic inhibition much more than at UIUC.

UVa Seminar

Title and Sponsors/Collaborators	2 slides	
Fatigue Problem, Prognosis Vision and Opportunities	5	
Fatigue Background	3	
Quad C Overview of UVa Fatigue Research (a, b, c, d)	4	
Details I: Crack Tip Damage Probes per Ro	10	(c)
Details II: Inhibition and Smart Coatings per Warner	10	(a)
Takeaways	1	
	35 slides	