

3.032 Mechanical Behavior of Materials

Fall 2007

HOW SHOULD I TRAVEL OVER IAP?

(A 3.032 PERSPECTIVE)

Method	Part	Material	$\Delta\sigma$ [MPa]	a_o [m]	K_{IC} [Mpa-rt-m]	a_c [m]	C	m	N_f [cycles]
Plane	wing	7075 aluminum		1.00E-03					
Train	track	301 stainless steel		1.00E-03					
Auto	piston	Alumina (Al ₂ O ₃)		1.00E-03					
Bicycle	frame	Ti alloy		1.00E-03					
Walking	femur	bone		1.00E-06					

Text removed due to copyright restrictions. Please see: pp. 64-66 in *Cannondale Bicycle Owner's Manual*, 2008.
http://www.cannondale.com/asset/iu_files/techcenter/2008_cannondale_bicycle_owners_manual_en.pdf

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How fatigue fracture initiates

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"Demonstration of Crack Propagation due to Fatigue"

http://www.sv.vt.edu/classes/MSE2094_NoteBook/97ClassProj/anal/kelly/fatigue.html

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Characteristic fatigue fracture surfaces:

Images removed due to copyright restrictions. Please see: Fig. 21.30 and 21.31 in Reed-Hill, Robert E., and Abbaschian, Reza. *Physical Metallurgy Principles*. Boston, MA: PWS Publishing Company, 1994. 4, 5, and 6 in http://www.sv.vt.edu/classes/MSE2094_NoteBook/97ClassProj/anal/kelly/fatigue.html

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Images removed due to copyright restrictions. Please see: any SEM of beachmarks in metal, such as http://www.tech.plym.ac.uk/sme/Interactive_Resources/tutorials/FailureAnalysis/Images/Fractography/Fatigue_beachmarks5.JPG

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Images and text removed due to copyright restrictions. Please see: Fig. 4 in Brown, Eric N., et al.

"Fracture and Fatigue Behavior of a Self-Healing Polymer Composite." *MRS Symposium Proceedings 735* (2003): C11.22

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How to stop fatigue fracture:

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Fig. 5.0 in Callister, William D. "An Introduction." *Materials Science and Engineering*. 3rd ed. New York, NY: John Wiley & Sons, Inc., 1994.

case-hardened steel gear

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How to stop fatigue fracture:

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Brown, Eric N., et al. "Fracture and Fatigue Behavior of a Self-Healing Polymer Composite."
MRS Symposium Proceedings 735 (2003): C11.22

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How to stop fatigue fracture:

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Fig. 1, 8, and 9 in Aglan, H. A., et al. "Fatigue Fracture Resistance Analysis of Polymer Composites Based on the Energy Expended on Damage Formation." *Journal of Reinforced Plastics and Composites* 22 (2003): 339-360.

Images and text removed due to copyright restrictions. Please see:
Fig. 1, Introduction, and Experimental Procedure in Brown, Eric N., et al. "Fracture and
Fatigue Behavior of a Self-Healing Polymer Composite." *MRS Symposium Proceedings* 735 (2003): C11.22