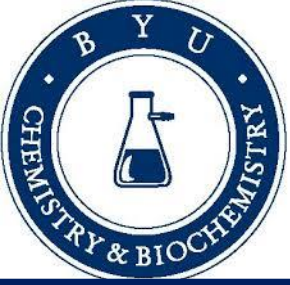


# Nondestructive Evaluation Using Second Harmonic Generation Spectroscopy

Shawn Averett, Dustin Broderick, James Patterson  
BYU Chemistry and Biochemistry



# Background: Nondestructive Evaluation

Nondestructive evaluation (NDE) is used to identify weakened parts and material before they fail.



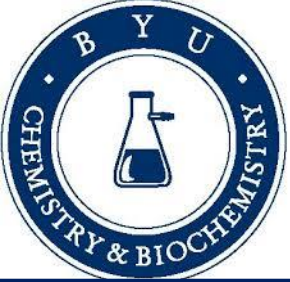
<http://content.time.com/time/photogallery/0,29307,1872172,00.html>



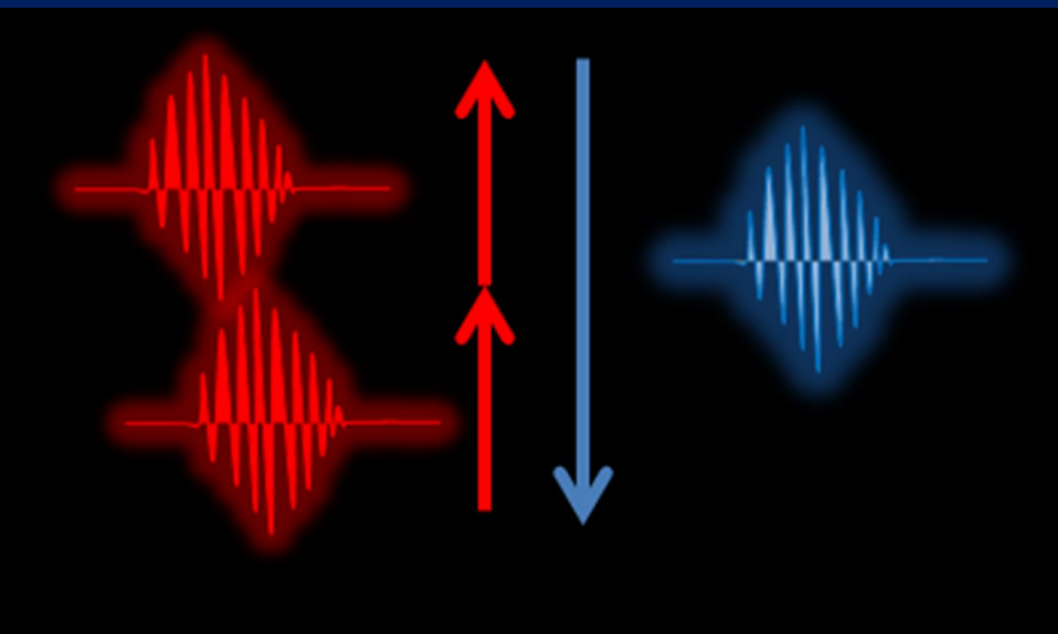
<http://35wbridge.pbworks.com/w/page/900718/Mianus%20River%20Bridge%20Collapse>



<http://www.industrytap.com/whatacaused-the-bangladesh-building-collapse-killing-over-800-1873>



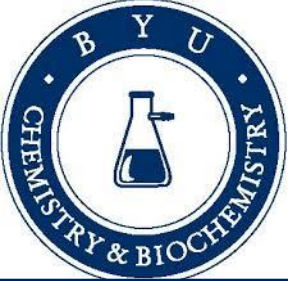
# Background: Second Harmonic Generation. (SHG)



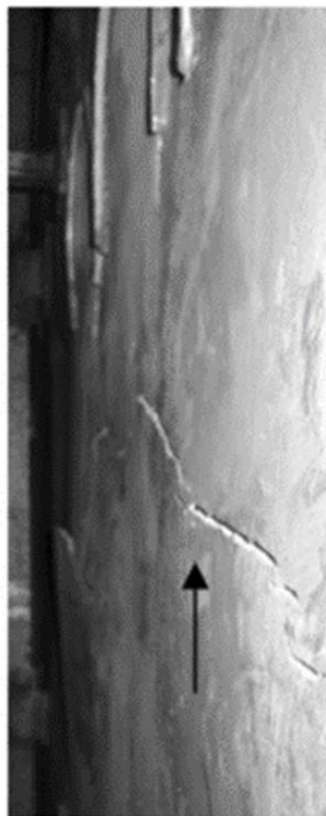
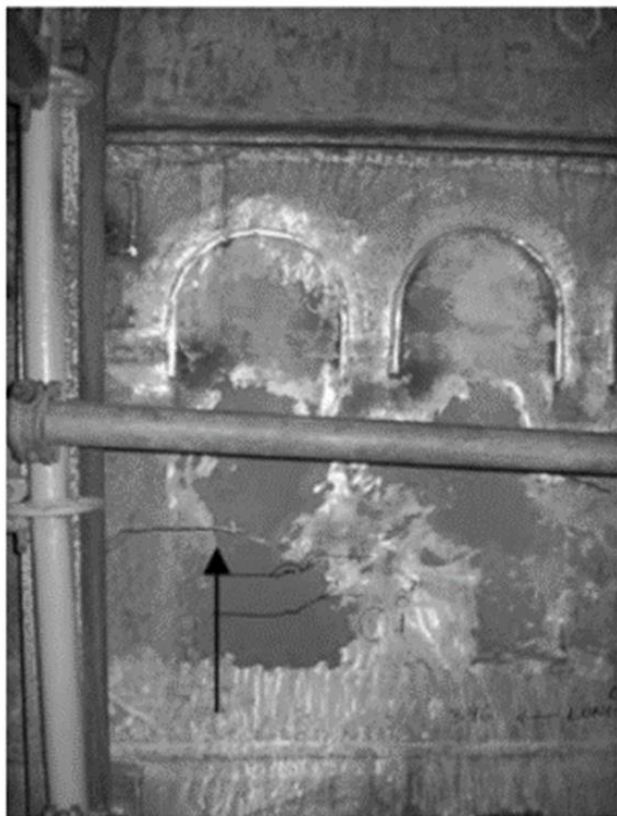
$$P_{\text{SHG}} = X^2 E(\omega) E(\omega)$$



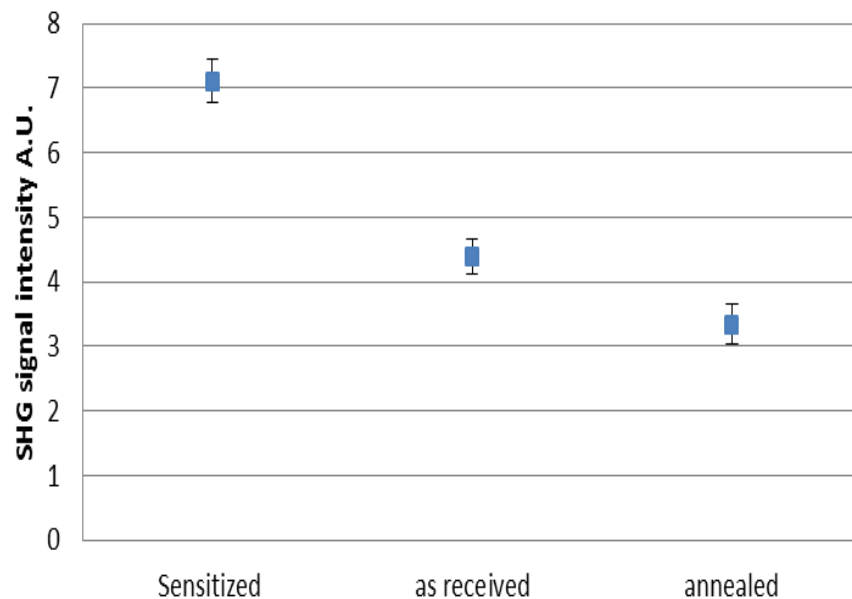




# A \$66 Million/Year Problem.

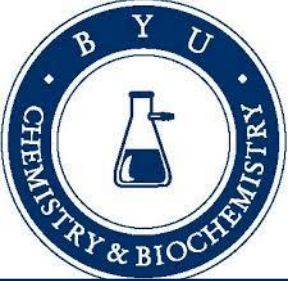


### Beta phase study Al 5456-H116



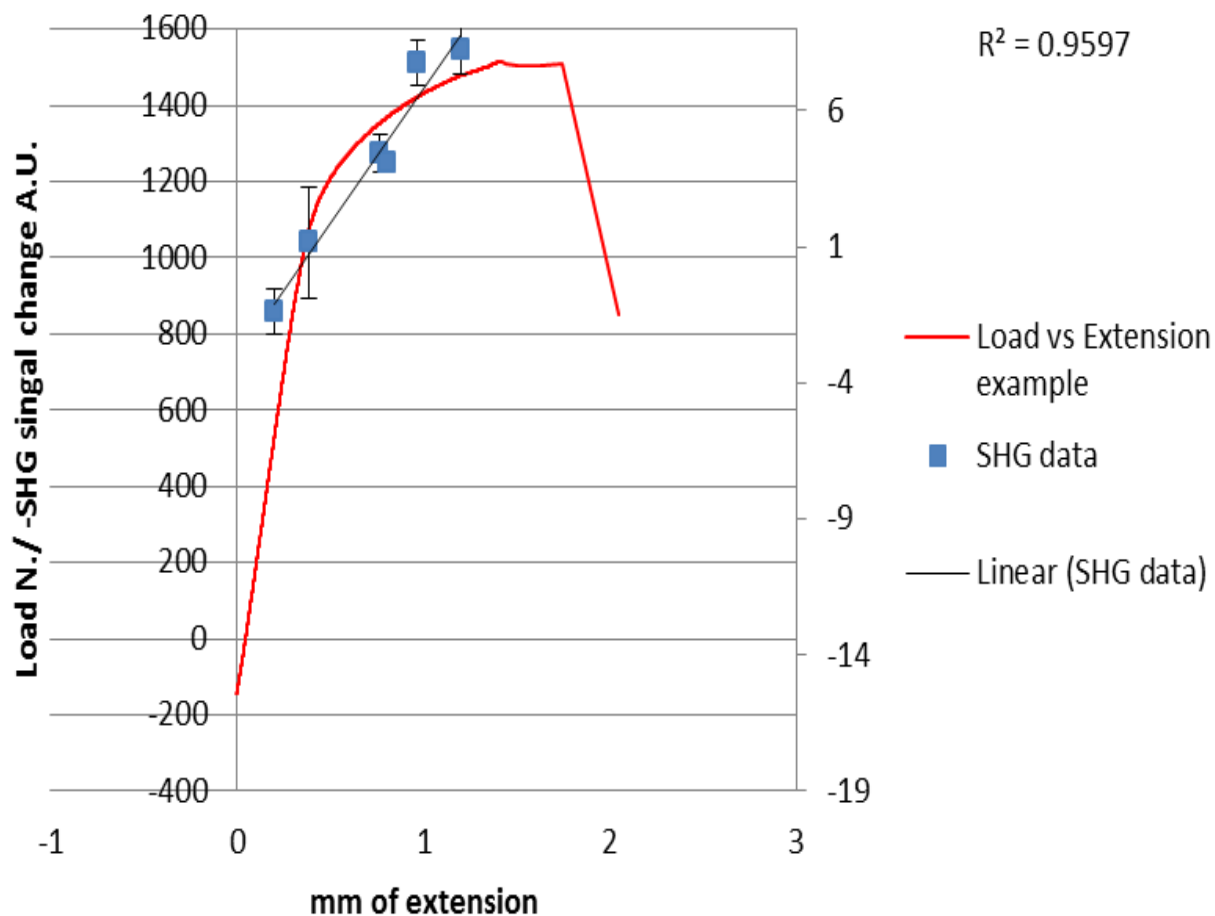
Schwarting, R.; Ebel, G.; Dorsch, T. J.: Manufacturing Techniques and Process Challenges with CG47 Class Ship Aluminum Superstructure Modernization and Repairs. American Society of Naval Engineers, 2011

Magnesium in naval grade aluminum migrates to the grain boundaries making the metal vulnerable to corrosion and failure.



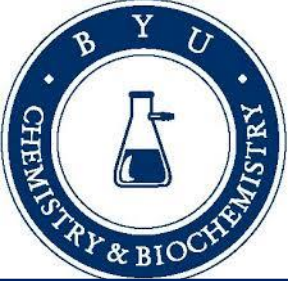
# Additional SHG Capabilities

## SHG mapping of L vs Ex curve



SHG was used to track mechanical deformation in aerospace grade aluminum.

SHG may be sensitive to changes in many other materials.



# Collaborations Sought, And Contact Information.

## We are Looking for:

- Partners to help move the technology development forward.
- Collaborators with expertise in other important material changes that SHG may be able to identify.

## Primary Investigator

James Patterson

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