Detection of Defects in C/C Composites Using Infrared Thermography

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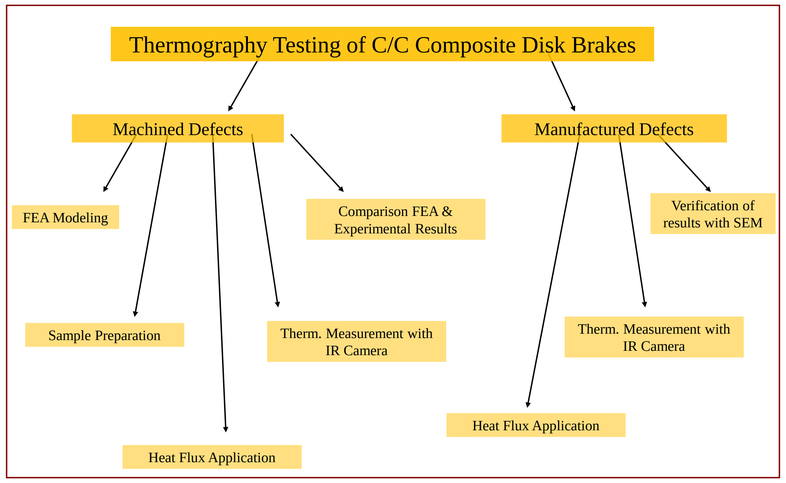
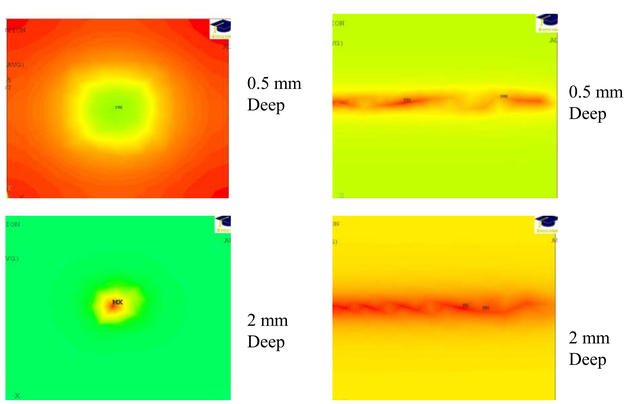
INTRODUCTION

The objective of this study is the use of NDE to determine subsurface defects in C/C composite disk brakes. With the use of existing NDE methods the equipment is expensive; this project deals with the ability to use thermography method but with less expensive equipment. The following main objectives of this work include;

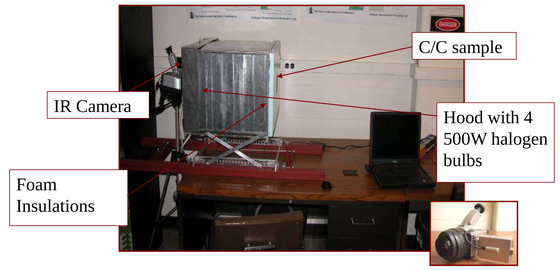
1) Use FEA Models to better understand the capabilities/limitations of the NDE methods available.
2) Use various thermography techniques currently available at SIUC to determine the capabilities/limitations.
3) Use both heat treated and non-heat treated C/C composite disk brake samples.
4) Create an inexpensive method for determining subsurface subsurface defects in C/C composite material as a visual/quality inspection system.



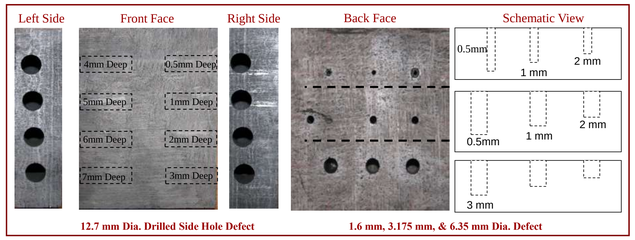
FEA Models



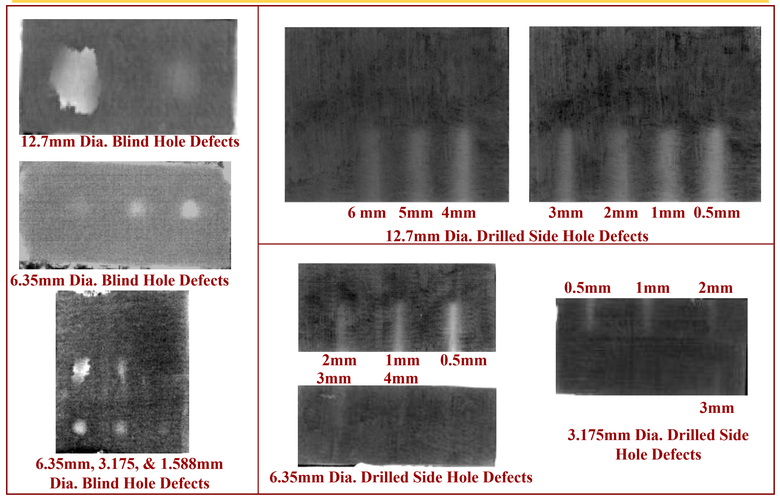
Experimental Setup

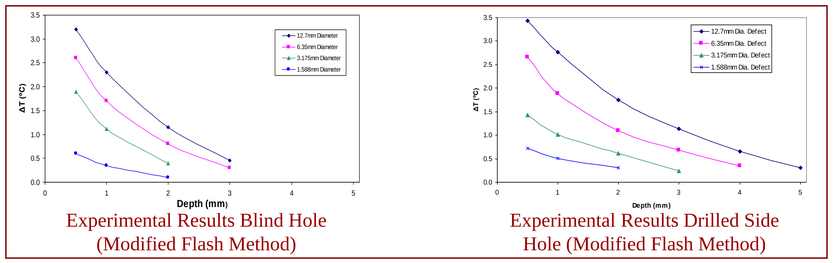


Mapping of CAFS-CVI C/C Samples



Experimental Results for Blind Hole and Drilled Side Hole Machined Defects (CAFS-CVI C/C)

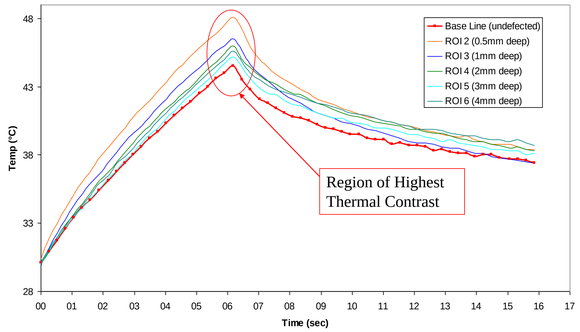




Experimental Results Blind Hole (Modified Flash Method)

Experimental Results Drilled Side Hole (Modified Flash Method)

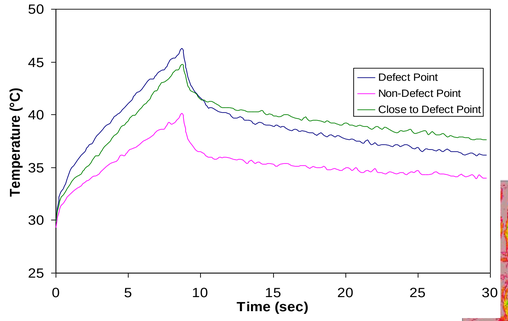
Thermal Contrast



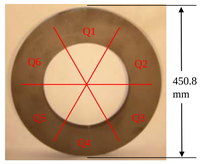
$$C(t) = \frac{T(t) - T_{ref}(t)}{T_{ref}(t)}$$

Thermal Contrast Equation

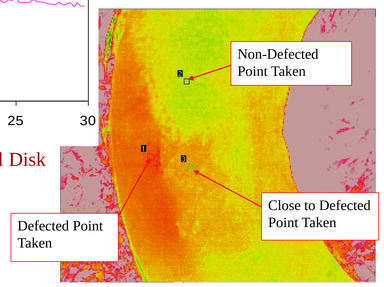
Commercial Defect Detection with Thermography

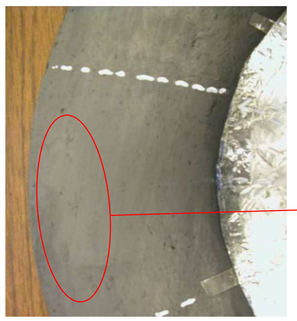


Temperature-Time Curve of Commercial Disk Brake

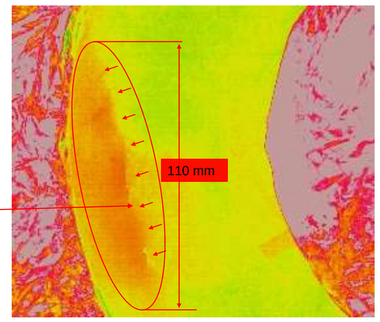


Heat Treated MABS C/C Disk Brakes





MABS C/C Disk Brake Image



MABS C/C Disk Brake Thermal Image of Delamination

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Intelligent Measurement & Evaluation Lab