



**43<sup>rd</sup> Turbomachinery  
30<sup>th</sup> Pump SYMPOSIA**

GEORGE R. BROWN CONVENTION CENTER  
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# MATERIALS IN CENTRIFUGAL COMPRESSOR AND STEAM TURBINES: SELECTION, PROCESSING, AND REPAIR

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# Instructors



## **Scot Laney, PhD**

Scot Laney is a Materials Engineer with the Elliott Group, in Jeannette, Pennsylvania. He joined Elliott Group in 2007, and has been involved with materials related R&D projects, failure analysis, and aftermarket support. He also has experience in the areas of high temperature oxidation/corrosion and protective coatings.

Dr. Laney received his BS (2001), MS (2004), and PhD (2007) degrees from the University of Pittsburgh in Materials Science and Engineering.



## **Derrick Bauer**

Derrick Bauer is a Supervising Engineer within the Materials Engineering department at the Elliott Group, in Jeannette, Pennsylvania. He joined Elliott Group in 2002, and has been involved with materials related R&D projects, failure analysis, production and aftermarket support, and remaining life assessments.

Mr. Bauer received his BS degree in 2002 and MS degree in 2011 from the University of Pittsburgh.



## **David Dowson**

David Dowson is a Service Engineer (Repairs) with the Elliott Group, in Jeannette, Pennsylvania. He has been involved with material related failure analysis, repairs to rotating and non-rotating equipment, and aftermarket support. He has co-authored papers on materials selection for hot gas expanders, repairs to turbomachinery components, defect tolerant design concepts and remaining life assessment.

Mr. Dowson received his B.S. degree (2003) from the University of Pittsburgh.

# Agenda

## Introduction to Basic Concepts in Materials Engineering

- Types of Materials
- Structure
- Phase
- Theoretical Strength
- Alloys
  - Structure
  - Phase
- Ferrous Metallurgy
  - What is Steel
  - Phases
  - Microstructures
  - Basis of Heat Treatments
  - Hardenability
  - Effects of Alloying Elements
  - Types of Stainless Steels

# Agenda

- Centrifugal Compressors
  - Rotating Components
    - Impellers
    - Shafts
  - Stationary Components
    - Casings
    - Diaphragms
    - Bolting
    - Piping
    - Seals
  - Materials, Manufacturing and Properties considerations for each component

# Agenda

## Steam Turbines

- Rotors
  - Manufacturing
  - Materials
  - Important Properties
- Blades
  - Manufacturing
  - Materials
  - Important Properties
- Casings
  - Manufacturing
  - Materials
  - Important Properties
- Nozzles and Diaphragms
  - Manufacturing
  - Materials
  - Important Properties
- Bolting
  - Materials
  - Important Properties
- Seals
  - Types
  - Materials
  - Important Properties

# Agenda

## Repairs to Turbomachinery

- Root Cause Failure Analysis
- NDT Inspection
- Welding Processes
- Centrifugal Compressors
  - Casings
  - Compressor Shafts
  - Impellers
- Steam Turbines
  - Casings
  - Rotors
- Case Studies

# Agenda

## Coatings

- Corrosion
- Fouling
  - Organic
  - Metallic glass
- Wear
  - Sliding
  - Solid particle erosion
  - Liquid droplet erosion
  - Wire wooling