



ASIA TURBOMACHINERY & PUMP SYMPOSIUM
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Materials in Centrifugal Compressor and Steam Turbines: Selection, Processing, and Repair

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Instructors



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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.



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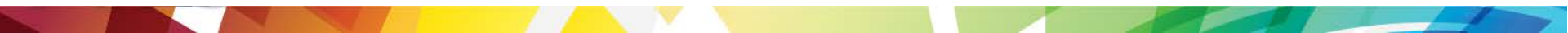
David Dowson is a Service Engineer (Repairs) with the Elliott Group, in Jeannette, Pennsylvania. He has been involved with material related failure analysis, repairs to rotating and non-rotating equipment, and aftermarket support. He has co-authored papers on materials selection for hot gas expanders,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



Abstract

Materials selection is significant with respect to performance, reliability, and longevity of turbomachinery, particularly given the increasing severity of the process environments. The trends are that the selection is becoming a cooperative effort between the OEM's and the customers and it is vital that all parties understand the implications of the materials selection and necessary manufacturing processes. This course reviews the material selection for major components for centrifugal compressors and steam turbines covering topics such as materials of construction, heat treatments, properties, fabrication and manufacturing methods, inspection methods, and compliance with industry specifications such as API and NACE along with other special requirements. Going beyond new equipment, the course will touch on the identification of damage mechanisms through root cause analysis and then delve into the procedures and documentation required to restore the components to operating condition. The course will end with a discussion of various coatings and surface treatments that can also be used to enhance the performance and/or longevity of the equipment.



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