Materials and Design for High Temperatures

A Practical, Case Study-based Training Program
Led by:

Wolfgang Hoffelner

15 Hours • 1.5 CEUs • 15 PDHs

About this Master Class (MC112)
Design for elevated and high temperature service requires specific measures for materials to maintain its integrity over long service periods. This two-day MasterClass provides insight into important aspects of performance of materials and its relation to design and residual life assessments of components. This course includes: a review of materials and material qualities which can be used at higher temperatures; response of materials to service loads at higher temperatures and consequential damage; and damage development under creep and fatigue loading (crack initiation and crack propagation). High Temperature design rules and Code related aspects of high temperature design will be considered in detail.

For more information and to register, visit go.asme.org/mc112
The ASME Master Class Series focuses on applications and case studies of a particular topic. Each Master Class is led by an ASME Master, an expert in his professional discipline, who brings a wealth of knowledge and practical examples to the forum. Participants are expected to have prior knowledge of the topic area to gain the most from this interactive environment. Sessions are focused on real world examples and case studies, with active class discussion and analysis.

About this MasterClass

This two-day MasterClass provides insight into important aspects of performance of materials and its relation to design and residual life assessments of components. Presented in two parts, the class will address two main topics, i.e. “Structural Materials and Damage in Elevated and High Temperature Applications” on day one, and “Design and Lifetime Assessments of Components Exposed to High Temperatures” on day two.

Materials and material qualities which can be used at higher temperatures is discussed in detail, as well as damage development under creep and fatigue loading (crack initiation and crack propagation). Consideration of high temperature design rules and code related aspects of high temperature design will be discussed with practical examples.

Upon completion, attendees will be able to

• Use high temperature materials data for design (time dependent allowable stresses)
• Identify damage occurring at elevated and high temperatures
• Assess damage evolution under creep, fatigue and its interactions
• Design for high temperature service and creep-fatigue interactions

Who Should Attend

This MasterClass is an essential resource for design engineers, materials engineers, fabrication, installation and construction engineers, consultants and authorities for boiler, piping, turbomachinery, and advanced nuclear plants. The course addresses individuals with intermediate knowledge level on materials and strength of materials being interested in a general understanding of high temperature materials properties and design for high temperature service.

About this ASME Master

Wolfgang Hoffelner is currently Managing Director of RWH consult Llc., a Swiss based consulting entity for materials and energy related consultancy. Prior to consulting, he was manager of the High Temperature Materials project at the Swiss Paul Scherrer Institute, and Senior Lecturer for High Temperature Materials at the Swiss Federal Institute of Technology (since 1986). Wolfgang also worked at ABB (formerly BBC) where he held different positions ranging from Research Scientist, Group Leader in the Laboratory, and Head of Section Mechanics and Materials for Gas Turbines and Combined Cycle Plants. In 1990, he joined the Swiss Company MGC-Plasma Inc. as a Board member where he was responsible for technology of metallurgical and environmental applications of thermal plasma. Wolfgang is currently an active member of various ASME Code committees, ASM and TMS. He has published a book on Materials for Nuclear Plants and more than 150 papers in scientific and technical books and journals. He is a contributing member to various ASME Code committees, including ASME Section III, Construction of Nuclear Power Plants.

MasterClass Requirements

This MasterClass is structured on the assumption that participants have a basic understanding of structural materials, strength of metals and alloys, classification of loads and determination of stresses, and stress allowables.
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AGENDA

The contents are presented in 2 parts, tentatively organized as shown. The two-day schedule allows for ample discussion and interaction with attendees. The instructors reserve the right to modify the content to address the audience’s needs and preferences.

Day One: 8:00 am – 5:00 pm

Part I: Structural materials and damage in elevated and high temperature applications

- Examples for plants and components operating at high temperature
- How can strength be obtained and maintained at high temperatures?
- Classes of high temperature materials (steels, superalloys, Al,Cu,Ti-based materials)
- Production technologies
- Creep and fatigue as challenge for design/damage assessments of components
- Data scatter and extrapolation of long-term creep and stress-rupture data
- Isochronous stress-strain curves
- Creep damage and fatigue damage and how can they interact.
- Subcritical crack growth under creep and fatigue

Day Two: 8:00 am – 5:00 pm

Part II: Design and life-time assessments of components exposed to high temperatures

- Multi-axiality and creep damage and fatigue damage.
- Problems with reliable data generation and interpretation
- Influence of cyclic hardening/softening
- Crack growth under creep-fatigue loading
- Design stresses, Design by rule/Design by analysis
- Structural discontinuities and cyclic loads
- Shake-down, ratchetting and buckling
- The linear life fraction rule (and its limitations)
- Advanced life-time assessment methods (and limitations)
- Strain control/creep-fatigue analysis
- Fitness for Service considerations