



Alloys and Coatings: Applications in Combustion Turbines

Course Description:

This 3-day course provides a comprehensive understanding of the alloys, failure analysis and coating systems and processes currently used in the combustion turbine (CT) industry. Beginning with an introduction to ferrous, non-ferrous and superalloys, the course will cover all aspects of component damage, life assessment, failure analysis and current and advanced protective coatings.

Emphasis will be placed on the heavy-frame gas turbines (> 50 MW). In addition to alloys, the course describes the more commonly used coatings, and focuses on the selection of both coating processes and materials for specific turbine applications. Both cold and hot section coatings will be described along with hardfacing coatings that provide increased wear and corrosion resistance. Specific case studies will be utilized for failure analysis.

A comprehensive knowledge of such alloys and coatings can enable one in improving the RAM (Reparability, Availability, and Maintainability) of turbomachinery.

Who Should Attend:

This course is targeted at those interested in gaining a comprehensive knowledge of state-of-art alloys and coatings in the CT industry. Those new to superalloy components and coatings and those who want an overview of current technology for turbine applications. Combustion turbine manufacturers (OEMs), users and operators, maintenance workers, managers, educators, equipment and material suppliers, repair and coating service providers will find educational benefits.

Course Outline: (3-days):

See attachment for a complete description of activities and lecture outlines.

Course Location:

La Quinta Inn Houston Stafford/Sugarland
(281) 240-2300 www.lq.com..
12727 Southwest Fwy, Stafford, TX 77477

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Course Instructors:

Dr. Purush Sahoo, Owner & President, Materials Solutions International.

Purush Sahoo earned his bachelors degree (with Honors) in Metallurgical Engineering from the Indian Institute of Technology, India and obtained his Ph.D. in Metals Science & Engineering from Pennsylvania State University.

He began his industrial career with Sermatech International where he was the Principal Investigator on the ATS (Advanced Turbine System) TBC (Thermal Barrier Coating) program for Westinghouse.

He joined Praxair-Tafa as Manager of Coatings in Concord, NH, where his duties included coatings, materials, and equipment development.

He then went to Cincinnati Thermal Spray as their Director of Technology. His responsibilities included development of thermal spray and dry film lubrication business.

He re-joined Sermatech as their Director of Engineering and Quality for the





two business units in the Texas Group, located in Houston, TX. Subsequently, he was the Business Unit Manager for the Component Repair and the Coatings operations in Texas.

In 2003, Purush joined Hickham Industries, Inc., as their Director of Coating Technologies & Development. His responsibilities include: Provide knowledge and guidance regarding all I.G.T./general turbomachinery coating practices, trends and developments; provide guidance to change, qualify and/or improve coatings; develop modifications to existing coatings as well as developing new coatings.

In 2006 Purush and his former colleagues started and began production operations of a coatings and engineering services company(American Surface Modifications) in Houston, TX

Dr. Srinivasan “Shanks” Shankar, Owner and President, Viker Technologies

Dr. Srinivasan Shankar was President of Sermatech Power Solutions, a \$180 million division of Teleflex till Jan 2003. Shanks was responsible for the global operations of the industrial gas turbine services business of Sermatech focused on building a position as the leading independent provider of full-service life cycle support. Shanks was with Sermatech for 7 years and he more than doubled sales and profits during this tenure. He has more than 25 years experience in high temperature materials critical to the turbomachinery market. As President of Sermatech Power Solutions, he was responsible for a broad range of activities related to servicing of turbomachinery and turbomachinery components. Shanks holds several patents in the area of high temperature materials, coatings and repair and has published several articles.



Prior to Sermatech, Shanks was Vice President- Engineering and Vice President -Coatings and IGT Repair operations at Turbine Components Corporation, a private company located in Branford, CT which was subsequently acquired by Howmet. Shanks was with TCC from 1982 to 1995 and developed a lot of high temperature coatings and repair techniques for both aircraft engine and industrial engine components. He patented a recast process and introduced the gas phase process for forming platinum aluminides.

Prior to TCC, Shanks was Manager- Technology at Howmet Corporation in Whitehall, Michigan (1977- 1982) where he was involved in the development of low pressure plasma spray process, development of diffusion aluminide coatings and casting development.

Shanks obtained his Bachelor of Technology degree from Indian Institute of Technology, Madras (Chennai), India in 1973 and his PhD in Materials Science from State University of New York at Stony Brook in 1977. At SUNY- Stony Brook he worked with Prof. Siegle on high temperature coatings. Shanks was one of the founding members of the Manufacturing Materials and Metallurgy Committee of the International Gas Turbine Institute (ASME) and served as the Chairman of the Committee for two years.

Currently Shanks is consulting for several large gas turbine engine manufacturers and suppliers in the US and overseas.

He is located in Berwyn, PA.

Alloys Coatings: 2008

Day/Time	Tutorial Title	Description	Hours
Day 1			
8:00	Registration	Training Hall	0.5
8:30	General Introduction	Intro of students, instructors, course outline	0.25
8:45	Materials used in Turbomachinery, primarily CT components	Overview of ferrous and non-ferrous alloys used in manufacturing, primary focus on GT components, OEM GT evolution and alloy development; superalloys and their evolution, advanced GT design evolution	1.25
10:00	Break		0.25
10:15	Turbomachinery degradation	An overview of material degradation mechanisms as they apply to turbomachinery will be reviewed. Instances of catastrophic failure, economic considerations to repair and coat parts, oxidation and hot corrosion, wear and erosion, and degradation of coatings during service	1
11:15	Materials used in Turbomachinery, primarily CT components	Overview of ferrous and non-ferrous alloys used in manufacturing, primary focus on GT components, OEM GT evolution and alloy development	0.75
12:00	Lunch		1
1:00	Coating Processes	An overview of the major coating processes - wire arc, plasma, HVOF, EB-PVD	1.25
2:15	Coatings - Technologies	Various surface engineering modification technologies and comparisons; Thermal spray, PVD, CVD, Welding, etc.	1
3:15	Break		0.25
3:30	Coatings - Technologies	Continued	1.5
5:00	Close		
Day 2			
8:00	Thermal spray coatings	Overview of the major TS coatings used in the GT industry: application processes and standards	2
10:00	Break		0.25
10:15	IGT Standard Coatings	Focus on MCrAlY, TBC, Chrome Carbide and other heavily used coatings.	1.75
12:00	Lunch		1
1:00	Coating materials, Case studies	Powders, wires; Spraying of IGT components	2
3:00	Break		0.25
3:15	Diffusion coating	Overview of the major diffusion coatings and processes: aluminides, chromides	1.75
5:00	Close		
Day 3			
8:00	Failure analysis	FA of coatings, case studies	2
10:00	Break		0.25
10:15	Compressor coatings	Cold coatings and processes	0.75
11:00	New Horizons	F-Tech coatings; recent developments	1
All participants will then travel to ASM's site for a visit on how coatings are applied in production.			
12:00	Lunch	To be provided at ASM	1
1:00	Practical Session	ASM Shop Visit	2
3:00	Break		0.25
3:15	Q&A	Panel session with instructors	1
4:15	Conclusion	Award certificates	