

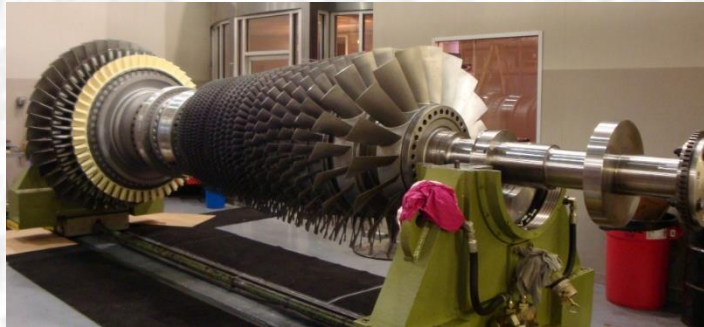
SUPERALLOYS AND COATINGS:

Materials for Gas Turbines

Presented by:

Dr. D.H. Boone, Dr. W. Miglietti and Prof. G.E. Fuchs

5-8 May, 2020



This 4-day course provides a basic level of knowledge on the metallurgy, manufacturing, mechanical, and surface behavior of these critical gas turbine hot-section alloys and components. Coating performance, selection, and application techniques are also covered, as these technologies are so vital to subsequent repair and refurbishments strategies. Of particular importance is the information on component degradation, remaining life assessment, and repair workscoping.

The next course will be held at the University of Florida (MSE Department), Gainesville, FL, 5-8 May, 2020. Discounts are provided for early registration and groups of 3 or more.



This course, is designed to provide a basis for the engineering, supervisory and purchasing decisions concerning gas turbine equipment operation, and component repair, refurbishment, refitting, and replacement where superalloys are involved. It has been given both publically, and "in-house" to OEM's, utilities, airlines, designers, manufacturers, government agencies, users and repair groups. This course has been presented over 80 times, has become the standard training course of the entire gas turbine industry and has received very strong feedback from students, as seen below.

"I wish I took this course at the start of my career 15 years ago!"

"The materials covered will directly affect our ability to coat product. Our staff is primarily manufacturing based, and the course did well to bridge the technical information to a practice use of the info."

"The subject matter was specific to actual materials being processed. The course covered a good understanding of metallurgy & applied coatings."

For course questions and registration, please contact: PROF. GERHARD E. FUCHS, (352)846-3317, gfuch@mse.ufl.edu

SUPERALLOYS AND COATINGS: *Materials for Gas Turbines*

**Dr. Donald H. Boone, Dr. Warren Miglietti and
Prof. Gerhard E. Fuchs**

**5-8 May, 2020 University of Florida, Materials Science & Engineering Department
(Rhines Hall), Gainesville, FL.**

Tentative Schedule

TUESDAY, 5 May		WEDNESDAY, 6 May		
08:00	WELCOME & INTRODUCTION	DHB/WM & GEF	08:00 Metallurgy of the Casting Process	GEF
08:30	Superalloys in Turbine Design	DHB/WM	09:00 Directionally Solidified and Monocrystal Castings	GEF
09:30	BREAK		10:00 BREAK	
09:45	Superalloys for Gas Turbines	GEF	10:15 Heat Treatment of Superalloys	GEF
10:30	What Makes Superalloys Strong?	GEF	11:00 What's New, What's Happening	GEF
11:45	Processing of Superalloys	GEF	12:00 The Stability of Superalloys	GEF
12:30	LUNCH		12:30 Lunch	
01:30	Processing of Superalloys	GEF	01:30 Surface Attack; Oxidation and Hot Corrosion Principles	GEF
02:00	Principles of Nickel Base Alloys	GEF	02:30 Alternative Materials	GEF
03:00	BREAK		03:00 BREAK	
03:15	Principles of Cobalt Base Alloys	GEF	03:15 TiAl-Based Alloys	GEF
03:45	Principles of Ni-Fe Base Alloys	GEF	04:00 Degradation of Coatings under Service Conditions	DHB/WM
04:30	Metallurgy of the Casting Process	GEF	04:30 CLOSE	
05:30	CLOSE			
06:00	Cocktail Hour and Reception			
THURSDAY, 7 May		FRIDAY, 8 May		
08:00	Protective Coatings: Introduction	DHB/WM	08:00 Coatings, Ranking and Selection	DHB/WM
08:30	Aluminides – Diffusion, Modified and Vapor Phase	DHB/WM	08:30 Repair & Rejuvenation: Introduction and Considerations	DHB/WM
09:30	BREAK		09:30 R&R Cleaning, Stripping	DHB/WM
09:45	Overlay Coating Processing	DHB/WM	10:00 BREAK	
10:45	Thermal Spray Coatings Processing	DHB/WM	10:15 NDI Techniques	DHB/WM
11:30	Overlay Coating Compositions	DHB/WM	11:15 Weld and Braze Repair Techniques; Recent Advances & Limitations	DHB/WM
12:30	LUNCH		12:30 LUNCH	
01:30	Thermal Barrier Coating	GEF	01:30 Component R&R Summary	DHB/WM
02:30	BREAK		02:00 Component Life Assessment, Philosophy & Procedures incl. Case Studies	DHB/WM
02:45	Coating Mechanical Property Considerations	DHB/WM	03:30 Course Recap, Discussion	GEF & DHB/WM
03:30	Additive Manufacturing (AM)	DHB/WM	04:30 CLOSE	
04:30	CLOSE			

SUPERALLOYS AND COATINGS:

Materials for Gas Turbines

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This 4-Day course presents a basic level of knowledge of the metallurgy, manufacture, mechanical and surface behavior of these critical turbine hot section alloys. Most importantly, the course also provides strong coverage of coating protection and the technologies vital to repair and refurbishment such as coating stripping and re-coating, welding, brazing, HIPing and re-heat treatment. Thus, a sound working knowledge for the decisions concerning repair, refurbishment, retrofitting and replacement is provided.

Please register the following students for the "Superalloys" 4-Day Course to be given at the University of Florida, Materials Science & Engineering's excellent technical facilities in Gainesville, FL. Information on housing options in the area will be provided, Tuesday through Friday, 5-8 May, 2020. Transportation between the hotel and short course venue will be provided. The specific course location along with more specific travel and hotel information will be supplied with reservation confirmation.

NAME: _____ TITLE: _____ Phone
Fax
e mail

COMPANY: _____

ADDRESS: _____

CITY: _____

STATE/ZIP/COUNTRY: _____

4-Day fee, including USB thumb-drive with notes, is \$2,200.00/student; a \$100 discount available until 15 March. There is also a 10% Group discounts for 3 or more students.

Hard copy of the ~1600 pages of notes, available at check in when pre ordered, \$250.00

All registrations fees (and payments for hard copies of notes) MUST be paid in full before the first day of class, otherwise the student will not be allowed to attend.

Payment accepted for all major credit cards or bank wire transfer information is also available.

Please send registration form and payment to: Gerhard E. Fuchs
gfuch@mse.ufl.edu
(352)846-3317

SUPERALLOYS AND COATINGS

Materials for Gas Turbines

COURSE INSTRUCTORS

Donald H. Boone, Ph.D.



Industrial Consultant and President of BWD Turbines Limited and Boone & Associates, Inc. His expertise and experience includes the areas of protective coatings and their processing, the effects of structure on performance for protection and for resulting mechanical properties, repair and rejuvenation and welding and advanced brazing techniques for propulsion and power generating gas turbines. Dr. Boone was previously associated with Pratt and Whitney Aircraft's AMRDL, Temescal Coatings Div., Lawrence Berkeley Labs, and the Naval Postgraduate School. Dr. Boone has authored over 200 technical publications and holds a number of patents in the high temperature alloy and coatings field.

Gerhard E. Fuchs, Ph.D.



Dr. Fuchs worked in the aerospace and nuclear power generation industries for 12 years before joining the MSE department at the University of Florida in 1998. His research has focused on the processing, microstructure and properties of intermetallic alloys, Ni-base alloys and superalloys. Dr. Fuchs continues to work closely with industry, laboratories and other academic institutions and has developed a new graduate-level course on "High Temperature Alloys". Dr. Fuchs is active several professional societies, serving on several committees, including the High Temperature Alloys Committee (TMS) and Seven Springs International Symposium Committee (TMS). Dr. Fuchs has also authored more than 75 technical publications and edited two books in the field of high temperature alloys.

Warren Miglietti, Ph.D.



patents.

Dr. Miglietti is currently the President and Principal Metallurgical Consultant of Miglietti and Associates, LLC. Prior to this he was Director of Repair Technology at ProEnergy and worked for 7 years at PSM, 5 years at GE's Repair Development Center and 5 years for Sermatech International as a component repair engineer and as a process repair engineer. His principal responsibility is the development of novel repair techniques and processes for components, operating in advanced land-based gas turbine engines, such as the Frame 7FA+e, GT24/26 and W501F/M501F engines. He has over 30 years of experience and expertise in the Welding, Brazing, FIC, Acid Stripping and Heat Treatment of Ni and Co-base superalloys. Dr. Miglietti is the chairman of the Commission XVII – "Brazing and Diffusion Bonding" of the International Institute of Welding (IIW) and was past chairman of the Manufacturing, Materials and Metallurgy Committee of IGTL. He has authored or co-authored 47 technical papers and has 12 repair technology