

IIW International Conference on Welding for Repair and Life Extension of Plants and Infrastructure 2012

**Held at the 65th Annual Assembly & International Conference of
the International Institute of Welding**

**Denver, Colorado, USA
12-13 July 2012**

ISBN: 978-1-62748-341-4

Printed from e-media with permission by:

Curran Associates, Inc.
57 Morehouse Lane
Red Hook, NY 12571



Some format issues inherent in the e-media version may also appear in this print version.

Copyright© (2012) by International Institute of Welding
All rights reserved.

Printed by Curran Associates, Inc. (2013)

For permission requests, please contact International Institute of Welding
at the address below.

International Institute of Welding
Z1 Paris Nord II – 90, rue de Vanesses
93420 Villepinte - FRANCE

Phone: +33 1 4990 3608

iiw@iiwelding.org - www.iiwelding.org

Additional copies of this publication are available from:

Curran Associates, Inc.
57 Morehouse Lane
Red Hook, NY 12571 USA
Phone: 845-758-0400
Fax: 845-758-2634
Email: curran@proceedings.com
Web: www.proceedings.com

TABLE OF CONTENTS

HOUDREMONT LECTURE:

Materials and Welding Considerations for Determination of Continued Operation, or Run/Repair/Refurbishment for Life Extension	1
<i>Carl D. Lundin</i>	

SESSION ONE: PLENARY SESSION - DESIGN AND RISK ASSESSMENT FOR REPAIR

Fracture Mechanics Based Life Assessment Procedures for Weldments Containing Residual Stresses	51
<i>K. Nikbin</i>	
The Future Role of NDT as Part of Predictive Maintenance Strategies in Lifetime and Ageing Management-More Than Only a Quality Tool to Control Repair	65
<i>Gerd Dobmann</i>	
Repair Weld Residual Stresses and Mitigation Techniques	86
<i>Pingsha Dong</i>	

SESSION TWO - AUTOMATED REPAIR PROCEDURES

Advanced Programming Techniques for Robotic Weld Repair of Worn Components	100
<i>John Norrish, Zengxi Pan, Nathan Larkin</i>	
Effect of Process Parameters on Pulsed-Laser Repair of Directionally-Solidified Superalloy	110
<i>Leijun Li, Andrew Deceuster, Chunbo (Sam) Zhang</i>	
Advanced Welding Technologies for Challenging Power Plant Repairs	125
<i>Donna Sun</i>	
Remote Hyperbaric Welding for Hot Tapping into Subsea Pipelines	131
<i>David Yapp, Neil Woodward, Mike Armstrong, Kjell Edvard Apeland, Jan Olav Berge, Richard Verley</i>	

SESSION THREE - REPAIR AND LIFE EXTENSION OF POWER GENERATION PLANT AND EQUIPMENT – I

Experiences in In-situ Repair Welding of Steam Turbine Shrouds and Blades	139
<i>Baldev Raj, A. K. Bhaduri</i>	
Metallurgical and Computational Design of Welding Consumables for High Irradiation Environments	151
<i>W. A. Good, S. S. Drera, D. L. Olson</i>	
Nuclear Power Plant Repair	174
<i>Peter Nerman</i>	
Application of Novel Repair Methods to Advanced Materials	186
<i>Jerry E. Gould, R. Nick Kapustka</i>	

SESSION FOUR - REPAIR AND LIFE EXTENSION OF POWER GENERATION PLANT AND EQUIPMENT – II

Solutions for Repair of Creep Strength Enhanced Ferritic Steels	202
<i>Jonathan Parker</i>	
Life Assessment and Service Extension of Welded Power Plant Components	214
<i>Bilal Dogan, Ahmed Shibli</i>	
Welding Consumables for Advanced Boron-Cobalt Alloyed 9%Cr-Mo Creep Resisting Steels for Power Generation	227
<i>Zhuyao Zhang, Graham B. Holloway</i>	
Effective Repair of Industrial Gas Turbine Blades and Vanes Utilizing Welding and Diffusion Brazing	238
<i>Warren Miglietti</i>	

SESSION FIVE - REPAIRS FOR CYCLICAL SERVICE

Retrofitting Engineering for Fatigue Damaged Steel Structures..... 251
Chitoshi Miki

Residual Stresses in Austenitic and Ferritic Steel Weld Repairs..... 265
P. Hurrell, C. Gill, B. Pellereau, S. Garwood, J. Francis, A. Mark, M. Smith, J. Bouchard

Repairs for Offshore Structures..... 276
John Bruskotter

Fracture Mechanics Assessment of a Failure Case at a Steel Tower of a Wind Energy Converter..... 278
A. Hobbacher

SESSION SIX - REPAIR FOR ENERGY APPLICATIONS

Factors Affecting Repair of Hydrogen Charged Vessels..... 290
Richard Pargeter, Dave Godfrey

The Evolution of Predicting Burnthrough for In-service Welding..... 302
M. A. Boring

Control of Hydrogen Cracking for In-Service Repair of Pipelines 313
William A. Bruce

Temper Bead Repair of T91 Using EPRI P87 Filler Metal..... 326
J. A. Siefert, J. P. Shingledecker

SESSION SEVEN - REPAIR PROCEDURE QUALIFICATION AND PERFORMANCE

Qualifying Repairs for High Temperature Service..... 345
William F. Newell Jr.

Qualification of Repair Procedures and Personnel..... 355
Walter J. Sperko

Repair of Ships and Offshore Structures – A Classification Society Perspective..... 361
D. Miller, W. Hirnikel, M. Castro

Development of a Temper Bead Welding Procedure for an Amine Tower Repair and Post Service Assessment..... 369
William Mohr, Yu-Ping Yang, Matt Boring

Qualifying Repairs for Ultra-High Temperature Service 380
Martin Prager

SESSION EIGHT - REPAIR OF MACHINERY AND EQUIPMENT

Field Repair of Welded Structure Mining and Construction Equipment Applications 396
Glenn Forthofer, Kevin Stump, Jim Forck, Howard Ludewig

A Systematic Approach for Maintenance and Repair Welding..... 406
Phillip I. Temple

Recent Advancements in Weld Repair of Aluminum Structures for Naval Applications 436
Maria Posada, Kimngoc Tran, David Lammlein, Johnnie J. Deloach

SESSION NINE - REPAIR OF SPECIAL MATERIALS

The Repair of Aluminum Structures 462
Tony Anderson

Ni-base Weld Overlay for Repair in the Nuclear Power Industry..... 469
John C. Lippold

High Temperature Failure of Ferritic to Austenitic Dissimilar Welds..... 477
John. N. Dupont

Author Index