

## Stainless Steels & Alloys:

Why They Resist Corrosion & How They Fail

### Registration Form

*Photocopies of this form may be used for registrations.  
You can also register online at [www.corrosionclinic.com](http://www.corrosionclinic.com)*

Please register the following person(s) for the above course (please TYPE or PRINT clearly):

1. Dr/Mr/Ms \_\_\_\_\_  
Designation \_\_\_\_\_

2. Dr/Mr/Ms \_\_\_\_\_  
Designation \_\_\_\_\_

3. Dr/Mr/Ms \_\_\_\_\_  
Designation \_\_\_\_\_

\*delete where inappropriate

Enclosed is a cheque / bank draft No. \_\_\_\_\_  
for S\$ \_\_\_\_\_ (payable to “**WebCorr Corrosion Consulting Services**”) being Registration Fee for the above person(s).

Organization \_\_\_\_\_  
Contact Person \_\_\_\_\_  
Contact Dept \_\_\_\_\_  
Telephone \_\_\_\_\_ Fax \_\_\_\_\_  
Email \_\_\_\_\_

Crossed cheques should be made payable to “**WebCorr Corrosion Consulting Services**” and mailed together with the registration form to:

### WebCorr Corrosion Consulting Services

Toa Payoh Central, PO Box 225,  
Singapore 913108

Tel: (65) 64916456 Mobile: (65) 97110759

Fax: (65) 64916456

Email: [webcorr@corrosionclinic.com](mailto:webcorr@corrosionclinic.com)

<http://www.corrosionclinic.com>

## Course Details

**Date:** TBA  
**Time:** 9:00 am to 5:00 pm  
**Venue:** Spring Singapore  
**Course Fee:** S\$795 (GST not applicable)  
**Closing Date:** 4 weeks before course date  
**Discount:**  
**Group:** (3 or more people): 10%  
**Early-bird:** N% **if paid** “N” months  
before the course  
commencing date

### Withdrawal/Refund Policy:

Withdrawal or replacement should be conveyed to the organizer in writing (email or fax). An administration charge of 50% of the course fee will be levied if the withdrawal notice is received less than 4 working days before the course commencing date. No refund will be made for withdrawal notice received 2 working days and less.

### Certificates:

Certificate of attendance will be given to participants with at least 75% attendance of the course.

### Cancellation:

WebCorr reserves the right to cancel the course and fully refund the participants should unforeseen circumstances necessitate it.

## Stainless Steels & Alloys: Why They Resist Corrosion & How They Fail

*Conducted by:*

**Dr. Qiu Jianhai** *BEng PhD CEng MIM FICorr  
NACE Certified Corrosion Specialist*

*Date:*  
**TBA**

*Venue:*  
**Spring Singapore  
2 Bukit Merah Central  
Singapore 159835**

*Organized by:*



### **Course Overview:**

Stainless steels and alloys are perceived to be corrosion resistant but often failed unexpectedly during service. This course will discuss everything you wanted to know about stainless steels and alloys including super-duplex stainless steels and high-nickel-chrome alloys, from its classifications, compositions, microstructures, metallurgy and mechanical properties to corrosion resistance properties – why they resist corrosion and how they fail in service conditions. Practical advice on the use and care of stainless steels will be discussed. This 1-day corrosion short course provides an excellent avenue for corrosion practitioners, designers, technical managers, inspection and maintenance engineers, quality control personnel and those involved in failure analysis to update their appreciation of corrosion resistance of stainless steels and alloys.

This corrosion short course can be taken as in-house training course, online course and distance learning course worldwide. It can also be customized to meet the specific needs of your organization.

### **Course Contents**

This corrosion short course covers a wide range of testing and monitoring techniques from conventional weight loss coupons, ER and LPR to advanced electrochemical impedance spectroscopy (EIS) for routine applications such as rapid screening of corrosion inhibitors, materials selection, failure analysis, corrosion rate measurement, life prediction, evaluation of paints, coatings, electroplating, on-line monitoring of industrial processes, determination of resistance to pitting and crevice corrosion, and the degree of sensitization of stainless steels and alloys.

#### **1 Corrosion & Society**

- 1.1 The economic, social, political and environmental impacts
- 1.2 Liabilities due to corrosion

- 2 Basic Concepts in Corrosion
  - 2.1 Terminologies and conventions
  - 2.2 Why do metals corrode
  - 2.3 How do metals corrode
  - 2.4 Overview of different forms of corrosion
- 3 Classification of Stainless Steels & Alloys
  - 3.1 Ferritic stainless steels
  - 3.2 Austenitic stainless steels
  - 3.3 Duplex stainless steels
  - 3.4 Martensitic stainless steels
  - 3.5 Precipitation hardening stainless steels
- 4 Chemical Compositions, Structures & Properties
  - 4.1 Composition, structure and mechanical strength
  - 4.2 Composition, structure and corrosion resistance
- 5 Effects of Intermetallics, Phases & Precipitates
  - 5.1 Submicroscopic sigma, chi and Laves phases
  - 5.2 Alpha prime phase and 475°C embrittlement
  - 5.3 Effects of carbides and nitrides
- 6 Why They Resist Corrosion:
  - Mechanisms of Corrosion Resistance
- 7 How They Fail: Major Forms of Corrosion
  - 7.1 Uniform corrosion
  - 7.2 Galvanic corrosion
  - 7.3 Intergranular stress corrosion cracking, weld decay and knife-line attack
  - 7.4 Crevice corrosion
  - 7.5 Pitting corrosion
  - 7.6 Microbiologically-Influenced Corrosion (MIC)
  - 7.7 Environment-sensitive cracking
  - 7.8 Corrosion fatigue
  - 7.9 Fretting
  - 7.10 Erosion corrosion, impingement attack and cavitation damage
  - 7.11 Stray current corrosion
- 8 How to Control and Prevent Corrosion
  - 8.1 Materials Selection
  - 8.2 Design Against Corrosion
  - 8.3 Corrosion Resistant Coatings
  - 8.4 Anodic Protection
  - 8.5 Good practices for the optimal performance of stainless steels and alloys: The DOs and DON'Ts

### **Who Should Attend**

Users of stainless steels, plant maintenance personnel in pharmaceutical, petrochemical, power generation, oil and gas, marine and any other industry that is involved in fabrication, design, installation and operation of stainless steel components and systems.

### **Course Lecturer**

**Dr. Qiu Jianhai** *BEng PhD CEng MIM FICorr*

Dr Qiu obtained his BEng and PhD degrees both in the field of corrosion. He has 27 years of industry, university teaching, research and consulting experience in areas of corrosion and its prevention. He has been working closely with both local and overseas companies and has been an active consultant to governmental agencies, multinational companies and private organizations on corrosion and materials related issues such as corrosion design review, materials selection and life prediction, corrosion inspection and condition assessment, plant process optimization, corrosion training, corrosion testing and monitoring, trouble-shooting and corrosion failure analysis. Dr Qiu has recently completed the design of a cathodic protection system for the upcoming Marina Coastal Expressway (MCE) Tunnels. Dr. Qiu is also experienced in providing expert witness and assistance in litigation and arbitration matters related to corrosion and materials. He has authored over 120 technical papers and reports. Dr. Qiu was an invited contributing author to the latest edition of the world renowned ASM Handbook Vol.13C Corrosion: Environments and Industries. His biographical profile was included in the 7th edition of Marquis Who's Who in Science and Engineering.

Dr. Qiu is a NACE certified Corrosion Specialist (USA), the only person in Singapore certified to the highest professional level by NACE (National Association of Corrosion Engineers, USA). He is a Chartered Engineer registered with the Engineering Council (UK), a Fellow of the Institute of Corrosion (UK) and a professional member of the Institute of Materials, Minerals and Mining (UK). Dr. Qiu is the Singapore representative in the International Corrosion Council (ICC).