DIGBY D. MACDONALD
Professor in Residence, Departments of Nuclear Engineering
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EDUCATIONAL BACKGROUND

B.Sc. (1965) and M.Sc. (1966) in Chemistry, University of Auckland (New Zealand);
Ph.D. in Chemistry (1969), University of Calgary (Canada).

PROFESSIONAL EXPERIENCE (past 52 years)

- Professor in Residence, Departments of Nuclear Engineering and Materials Science and Engineering, University of California at Berkeley, 1/2013 – present.
- Distinguished Professor of Materials Science and Engineering, Penn. State Univ.,6/2003 – 12/2012.
- Chair, Metals Program, Penn. State Univ., 6/2001 – 6/2003
- Director, Center for Electrochemical Sci. & Tech., Penn. State Univ., 7/99 – 12/2012.
- Vice President, Physical Sciences Division, SRI International, Menlo Park, CA, 1/98 – 7/99
- Director, Center for Advanced Materials, Penn. State Univ., 7/91-3/2000
- Professor, Materials Science and Engineering, Penn. State Univ., 7/91 – 6/03.
- Deputy Director, Physical Sciences Division, SRI International, Menlo Park, CA, 4/87 - 7/91
- Laboratory Director, Mat. Research Lab., SRI International, Menlo Park, CA, 4/87 – 7/91
- Laboratory Director, Chemistry Laboratory, SRI International, Menlo Park, CA, 3/84 – 4/87
- Director and Professor, Fontana Corrosion Center, Ohio State University, 3/79 – 3/84
- Sr. Metallurgist, SRI International, Menlo Park, CA, 3/77 – 3/79.
- Sr. Research Associate, Alberta Research Ltd/University of Calgary, Canada, 3/75 – 3/77.
- Lecturer in Chemistry, Victoria University of Wellington, New Zealand, 4/72 – 3/75.

- Assist. Research Officer, Whiteshell Nuclear Research Establishment, Atomic Energy of Canada Ltd., Pinawa, Manitoba, Canada, 9/69 – 4/72.

CONSULTING ACTIVITIES (Partial list for the last twenty years).

OLI Systems
Electric Power Research Institute
SRI International
Stone & Webster Engineering Co.
Canadian Auto Preservation, Inc.
Numerous oil and gas companies.
SSM, Sweden.

PATENTS

1. D. D. Macdonald and A. C. Scott, "Pressure Balanced External Reference Electrode Assembly and Method", US Patent 4,273,637 (1981).
2. D. D. Macdonald, "Apparatus for Measuring the pH of a Liquid", US Patent 4,406,766 (1983).
3. S. C. Narang and D. D. Macdonald, Novel Solid Polymer Electrolytes", US Patent 5,061,581 (1991).
4. S. Hettiarachchi, S. C. Narang, and D. D. Macdonald, "Synergistic Corrosion Inhibitors Based on Substituted Pyridinium Compounds", US Patent 5,132,093 (1992).
5. S. Hettiarachchi, S. C. Narang, and D. D. Macdonald, "Reference Electrode Assembly and Process for Constructing", US Patent, 5,238,553 (1993).
6. D. D. Macdonald, et al, "Conducting Polymer for Lithium/Aqueous Syst.", US Prov. Pat. 60/119,360 (1998).
7. D. D. Macdonald, et al, "Polyphosphazenes as Proton Conducting Membranes", US Pat. Appl. 09/590,985 (1999).
8. D. D. Macdonald, et al, "Impedance/Artificial Neural Network Method…", US Prov. Pat. 60/241,871 (1999)
9. D. D. Macdonald, "Electrochemical Conditioning of Wine", US Prov. Pat. 60/295,080 (2001).
10. D. D. Macdonald, et.al., "Silicon Air Battery", Int. Patent WO2011/061728A1, May 26, 2011.
11. D. D. Macdonald, et.al., "Silicon Air Battery", US Patent, 8,835,060 B2, Sept. 16, 2014.

RELEVANT PUBLICATIONS (from a total of ≈ 1000).

1. D. D. Macdonald and G. R. Engelhardt, "Predictive Modeling of Corrosion". In: Richardson J A et al. (eds.), *Shrier's Corrosion*, 2, 1630-1679 (2010). Amsterdam: Elsevier.
2. J. Qiu, A. Wu, J. Yao, Y. Xu, Y. Li, R. Scarlat, D.D. Macdonald, "Kinetic study of hydrogen transport in graphite under molten fluoride salt environment". Electrochim. Acta, 2020, 136459 (2020).
3. J. Yao, J. Qiu, F. Carotti, R. Scarlat, D.D. Macdonald, Kinetic study of the hydrogen charging reaction on the graphite in aqueous solution and in room temperature ionic liquid (RTIL), Electrochimica Acta, 330, 135291 (2000).

4. D Kovalov, B Fekete, G R Engelhardt, D D Macdonald, Prediction of corrosion fatigue crack growth rate in alloys. Part I: General corrosion fatigue model for aero-space aluminum alloys, *Corrosion Science*, 141, 22-29 (2018).
5. D Kovalov, B Fekete, G. R Engelhardt, D. D Macdonald, Prediction of Corrosion Fatigue Crack Growth Rate in Alloys. Part II: Effect of Electrochemical Potential, NaCl Concentration, and Temperature on Crack Propagation in AA2024-T351, *Corrosion Science*, 152. 130-139 (2019).
6. P. C. Lu, D. D. Macdonald, M. Urquidi-Macdonald and T. K. Yeh. "Theoretical Estimation of Crack Growth Rates in Type 304 Stainless Steel in BWR Coolant Environments". *Corrosion*, 52(10), 768-785 (1996).
7. G. R. Engelhardt, M. Urquidi-Macdonald, and D. D. Macdonald. "A Simplified Method for Estimating Corrosion Cavity Growth Rates". *Corros. Sci*., 39(3), 419-441 (1997).
8. S.-K. Lee, P. Lv, and D. D. Macdonald, "Customization of the CEFM for Predicting Stress Corrosion Cracking in Lightly Sensitized Al-Mg alloys in Marine Applications", J. Solid State Electrochem., 17(8), 2319-2332 (2013).
9. J Shi, J Wang, D D Macdonald, Prediction of crack growth rate in Type 304 stainless steel using artificial neural networks and the coupled environment fracture model, *Corrosion Science*, 89, 69-80 (2014).
10. J Shi, J Wang, D D Macdonald, Prediction of primary water stress corrosion crack growth rates in Alloy 600 using artificial neural networks, *Corrosion Science*, 92, 217-227 (2015).
11. G. R. Engelhardt and D.D. Macdonald. "Modeling the Crack Propagation Rate for Corrosion Fatigue at High Frequency of Applied Stress", *Corros. Sci.,* 52(4), 1115-1122 (2010).
12. M. P. Manahan, D. D. Macdonald, and A. J. Peterson, Jr. "Determination of the Fate of the Current in the Stress-Corrosion Cracking of Sensitized Type 304SS in High Temperature Aqueous Systems". *Corros. Sci*., 37(1), 189-208 (1995).
13. G. R. Engelhardt, and D. D. Macdonald, "Deterministic Prediction of Pit Depth Distribution", Corrosion, **54**, 469-479 (1998).
14. D. D. Macdonald, M. Al-Rafaie and G. R. Engelhardt, "New Rate Laws for the Growth and Reduction of Passive Films", *J. Electrochem. Soc.,* **148**(9), B343 - B347 (2001).
15. D. D. Macdonald, "Stress Corrosion Cracking in Reactor Coolant Circuits – An Electrochemist's Viewpoint," *Power Plant Chemistry*, **6**, 731-747 (2004).
16. L. G. Million, A. Sun, D. D. Macdonald, and D. A. Jones, "General Corrosion of Alloy 22: Experimental Determination of Model Parameters from Electrochemical Impedance Spectroscopy Data," *Met. Trans. A,* **36A**, 1129 (2005).
17. D. D. Macdonald, "Internal/External Environment Coupling in Stress Corrosion Cracking", *J. Corr. Sci. Eng.*, **6**, Paper C065 (2005).
18. D. D. Macdonald "Deterministic Prediction of Localized Corrosion Damage – A Reflective Review of Critical Issues", *J. Corr. Sci. Eng*., **6**, Paper C066 (2005).
19. D. D. Macdonald, "On the Existence of our Metals-Based Civilization: I. Phase Space Analysis," *J. Electrochem. Soc.,* **153**(7), B213 (2006).
20. D. D. Macdonald and G. R. Engelhardt, "The Point Defect Model for Bi-Layer Passive Films", *ECS Trans*, 28(24), 123 – 144 (2010).

PROFESSIONAL ASSOCIATIONS AND HONORS

- Research Award, College of Engineering, Ohio State University, 1983.
- Selector of the Kuwait Prize for Applied Sciences, 1985.
- The 1991 Carl Wagner Memorial Award from The Electrochemical Society.
- The 1992 Willis Rodney Whitney Award from The National Association of Corrosion Engineers.
- Chair, Gordon Research Conference on Corrosion, New Hampshire, 1992.
- W.B. Lewis Memorial Lecture by Atomic Energy of Canada, Ltd., 1993, "in recognition of [his] contributions to the development of nuclear power in the service of mankind".
- Elected Fellow, NACE-International, 1994.
- Member, USAF Scientific Advisory Board, Protocol Rank: DE-4 (Lieutenant General equivalent), 1993-1997
- Elected Fellow, The Electrochemical Society, 1995.
- Elected Fellow, Royal Society of Canada, 1996. ("National Academy" of Canada).
- Wilson Research Award, College of Earth and Minerals Sciences, Pennsylvania State University, 1996.
- Elected Fellow, Royal Society of New Zealand, 1997. ("National Academy" of New Zealand).
- H. H. Uhlig Award, Electrochemical Society, 2001.
- U. R. Evans Award, British Corrosion Institute, 2003.
- Elected Fellow, Institute of Corrosion (UK), 2003.
- Appointed Adjunct Professor, Massey University, New Zealand, 2003.
- Appointed Adjunct Professor, University of Nevada at Reno, 2003.
- Elected Fellow, World Innovation Foundation, 2004.
- Elected Fellow, ASM International, 2005.
- Elected Fellow, International Society of Electrochemistry, 2006.
- Khwarizmi International Award Laureate in Fundamental Science, Feb. 2007.
- Trustee, ASM International, 2007-2010.
- Appointed SABIC Visiting Chair Professor, King Fahd University of Petroleum and Minerals, Dhahran, Saudi Arabia, 2010.
- Recipient, Lee Hsun Research Award, Chinese Academy of Sciences, China, 2010.
- Inducted Doctuer Honoris Causa by INSA-Lyon, Lyon, France, 2011.
- Nominated for the 2011 Nobel Prize in Chemistry for work on passivity.
- Awarded the Faraday Memorial Trust Gold Medal, 2012.
- Awarded the Gibbs Award in Thermodynamics by IAPWS, 2013
- Awarded Frumkin Medal, ISE, 2014.
- Awarded the OLIN Palladium Medal by the Electrochemical Society, 2015.
- Received the Ad Augusta Award from Auckland Grammar School, 2016.
- Plenary Lecturer, Corrosion2019, Nashville, TN, 2019.
- Plenary Lecturer, Mexican Electrochemical Society, 2019.
- Elected Member of the EU Academy of Science, 2019.

Signed. Digby D. Macdonald.