

Curriculum Vitae – Professor Dougal McCulloch

1. Statement

Professor McCulloch has published 171 papers in international refereed journals within the fields of advanced microscopy & microanalysis, carbonaceous solids and advanced coating materials. He currently has an h index of 31 and over the past 10 years, he has been awarded over \$3M in competitive grant funding as lead CI. Professor McCulloch established and is the current Director of the RMIT Microscopy and Microanalysis and is the Associate Dean Physics in the School of Science at RMIT University. He is a past President (2008-2010) of the Australian Microscopy & Microanalysis Society.

2. Qualifications

1994 Ph.D., RMIT University.
1989 B.App.Sc. (Applied Physics) (Distinction), RMIT University.

3. Employment History

2016- Associate Dean Physics, School of Sciences, RMIT University
2012-2016 Deputy Dean Physics Sciences, School of Applied Science, RMIT University
2001- Director of the RMIT Microscopy & Microanalysis Facility (RMMF)
2007 - Professor of Microscopy & Microanalysis, School of Applied Sciences, RMIT University

4. Prizes, Awards and Scholarships

2013 Vice-Chancellor's Research Excellence Award
2003 R.F. Bunshah Award, Best Paper in Symposium E at the International Conference on Metallurgical Coatings and Thin Films (ICMCTF)
2002 RMIT Research Award

5. Professional/Editorial Associations

2014- Editorial Board – Proceedings of the Royal Society A
2008-2010 President of the Australian Microscopy & Microanalysis Society (AMMS)
2006-2008 Secretary of the Australian Microscopy & Microanalysis Society (AMMS)
1994- Member Australian Microscopy & Microanalysis Society (AMMS)

6. Conference/Workshop Organisation/Editorial

2017 Organising Committee for the 11th Conference on New Diamond and Nano Carbons, Cairns May 2017
2013- Member of the Editorial Board for the Proceedings A of the Royal Society
2013- Member Program Advisory Committee for the Soft X-ray Beamline at the Australian Synchrotron
2012 Chair of the Amorphous Materials and Quasicrystals symposium at the APMC10/ICONN2012/ACMM22 joint conference in Perth, February 2012. 2008 Keynote Address "Advanced Coatings for Electronic and Optical Devices" at the SPIE conference "SMART Materials" held in Melbourne, December 2008.
2008 Chair of the "Nanomaterials" session at the 20th Australian Conference on Microscopy & Microanalysis, Perth.

7. Recent Publications

1. “Codeposition of amorphous zinc tin oxide using high power impulse magnetron sputtering: characterisation and doping”, H.N. Tran, E.L.H. Mayes, B.J. Murdoch, D.G. **McCulloch**, D.R. McKenzie, M.M.M. Bilek, A.S. Holland and J.G. Partridge, *Semiconductor Science and Technology*, **32**, 045013, 2017.
2. “Synaptic plasticity and oscillation at zinc tin oxide/silver oxide interfaces”, B.J. Murdoch; D.G. **McCulloch** and J.G. Partridge, *Journal of Applied Physics*, **121**, 054104, 2017.
3. “Carbon evolution during vacuum heat treatment of High Speed Steel”, A.F. Rousseau, J.G. Partridge, Y.M. Gözükar, D.G. **McCulloch**, *Vacuum*, **124**, 85-88, 2016.
4. “Duty cycle control in reactive high-power impulse magnetron sputtering of hafnium and niobium”, R. Ganesan, B. Treverrow, B. Murdoch, D. Xie, A.E. Ross, J.G. Partridge, I.S. Falconer, D.G. **McCulloch**, D.R. McKenzie and M.M.M. Bilek, *Journal of Physics D – Applied Physics*, **49**, 245201, 2016
5. “Memristor and selector devices fabricated from $\text{HfO}_{2-x}\text{N}_x$ ”, B.J. Murdoch, D.G. **McCulloch**, R. Ganesan, D.R. McKenzie, M.M.M. Bilek and J.G. Partridge, *Applied Physics Letters*, **108**, 143504, 2016.
6. “Mixed-mode high-power impulse magnetron sputter deposition of tetrahedral amorphous carbon with pulse-length control of ionization”, M.D. Tucker, R. Ganesan, D.G. **McCulloch**, J.G. Partridge, M. Stueber, S. Ulrich, M.M.M. Bilek, D.R. McKenzi and N.A. Marks, , *Journal of Applied Physics*, **119**, 155303, 2016.
7. “Nanocrystalline hexagonal diamond formed from glassy carbon”, T.B. Shiell, D.G. **McCulloch**, J.E. Bradby, B. Haberl, R. Boehler, and D.R. McKenzie, *Scientific Reports*, **6**, 37232, 2016.
8. “Optimizing HiPIMS pressure for deposition of high-k ($k = 18.3$) amorphous HfO_2 ”, R. Ganesana, B.J. Murdoch, J.G. Partridge, S. Bathgate, B. Treverrow, X. Dong, A.E. Ross, D.G. **McCulloch**, D.R. McKenzie and M.M.M. Bilek, *Applied Surface Science*, **365**, 336-341, 2016.
9. “Pulsed external magnetic fields increase the deposition rate in reactive HiPIMS while preserving stoichiometry: An application to amorphous HfO_2 ”, R. Ganesana, B. Treverrow, P. Denniss, D.G. **McCulloch**, D.R. McKenzie and M.M.M. Bilek, *Journal of Applied Physics*, **120**, 103301, 2016.
10. “Rectifying electrical contacts to n- type 6H-SiC formed from energetically deposited carbon”, M. Kracica, E. L. H. Mayes, H. N. Tran, A. S. Holland, D. G. **McCulloch** and J.G. Partridge, , *Carbon*, **102**, 141-144, 2016.
11. “Relationship between microstructure and electronic properties of energetically deposited zinc tin oxide”, B.J. Murdoch; D.G. **McCulloch** and J.G. Partridge, *Applied Physics Express*, **9**, 065501, 2016.
12. “The mechanical properties of energetically deposited non-crystalline carbon thin films”, M. Kracica, C Kocer, D.W.M. Lau, J.G. Partridge, J.E. Bradby, B. Haberl, D.R. McKenzie, and D.G. **McCulloch**, *Carbon*, **98**, 391-396, 2016.
13. “Co-deposition of band-gap tuned $\text{Zn}_{1-x}\text{Mg}_x\text{O}$ using high impulse power- and DC- magnetron sputtering”, E.L.H. Mayes, B.J. Murdoch, M.M.M. Bilek, D.R. McKenzie, D.G. **McCulloch** and J.G. Partridge, *Journal of Physics D:Applied Physics*, **48**, 135301, 2015.
14. “Effect of Schottky gate type and channel defects on the stability of transparent ZnO MESFETs”, S. Elzwawi, A. Hyland, M. Lynam, J.G. Partridge. D.G. **McCulloch** and M.W. Allen, *Semiconductor Science and Technology*, **30**, 024008, 2015.
15. “Influence of nitrogen-related defects on optical and electrical behaviour in $\text{HfO}_2\text{-xN}_x$ deposited by high-power impulse magnetron sputtering”, B.J. Murdoch, R. Ganesan, D.R. McKenzie, M.M.M. Bilek, D.G. **McCulloch** and J.G. Partridge. *Applied Physics Letters*, **107**, 12903, 2015.
16. “Mechanical Properties of Plasma Immersion Ion Implanted PEEK for Bioactivation of Medical Devices”, E.A. Wakelin, A. Fathi, M. Kracica, G.C. Yeo, S.G. Wise, A.S. Weiss, D.G. **McCulloch**, F. Dehghani, D.R. Mckenzie and M.M.M. Bilek. *ACS Applied Materials & Interfaces*, **7**, 23029-2340, 2015.
17. “Microstructural and tribological characterisation of a nitriding/TiAlN PVD coating duplex treatment applied to M2 High Speed Steel tools”, A.F. Rousseau, J.G. Partridge, E.L.H Mayes, J.T. Toton, M. Kracica, D.G. **McCulloch**, and E.D. Doyle, *Surface and Coatings Technology*, **272**, 403-408, 2015.
18. “Multilayered graphene films prepared at moderate temperatures using energetic physical vapour deposition”, D.T. Oldfield, D.G. **McCulloch**, C.P. Huynh, K. Sears and S.C. Hawkins, *Carbon*, **94**, 378-385, 2015.
19. “Self-assembled V_2O_5 interconnected microspheres produced in a fish-water electrolyte medium as a high-performance lithium-ion-battery cathode”, M.M. Rahman, A.Z. Sadek, I. Sultana, M. Srikanth, X.J. Dai, M.R. Field, D.G. **McCulloch**, B. Ponraj and Y. Chen, *Nano Research*, **8**, 3591-3603, 2015.
20. “Structural characterisation of energetically deposited $\text{Zn}_{1-x}\text{Mg}_x\text{O}$ films”, E.L.H. Mayes, D.G. **McCulloch** and J.G. Partridge, *Journal of Crystal Growth*, **412**, 103-108, 2015.
21. “Synthesis of highly tetrahedral amorphous carbon by mixed-mode HiPIMS sputtering”, R. Ganesan, D.G. **McCulloch**, N.A. Marks, M.D. Tucker, J.G. Partridge, M.M.M. Bilek and D.R. McKenzie, *Journal of Physics D:Applied Physics*, **48**, 442001, 2015.

22. "The role of pulse length in target poisoning during reactive HiPIMS: application to amorphous HfO_2 ", R. Ganesan, B.J. Murdoch, B. Treverrow, A.E. Ross, I.S. Falconer, A. Kondyurin, D.G. **McCulloch**, J.G. Partridge, D.R. McKenzie and M.M.M. Bilek, *Plasma Sources Science & Technology*, **24**, 035015, 2015.
23. "Optical properties and oxidation of carbonized and cross-linked structures formed in polycarbonate by plasma immersion ion implantation", E. Kosobrodova, A. Kondyurin, W. Chrzanowski, D.G. McCulloch, D.R. McKenzie, M.M.M. Bilek, *Nuclear Instruments and Methods in Physics Research Section B*, **329**, 52, 2014.
24. "The microstructure and properties of energetically deposited carbon nitride films", A.Z. Sadeka, M. Kracica, A. Moafi, D.W.M. Lau, J.G. Partridge and D.G. McCulloch, *Diamond and Related Materials*, **45**, 68, 2014.
25. "Formation of ordered arrays of gold particles by nanoindentation templating", S. Wong, A. Shalav, S. Ruffell, J.E. Bradby, M.R. Field, D.G. **McCulloch** and R.G. Elliman, in press, *Physica Status Solidi - Rapid Research Letters*, 2013.
26. "An energy landscape for carbon network solids", R.C. Powles, N.A. Marks, D.W.M. Lau, D.G. **McCulloch**, and D.R. McKenzie, *Carbon*, **63**, 416-422 (2013).
27. "Ultraviolet detection from graphitic-C/ $\text{Zn}_{1-x}\text{Mg}_x\text{O}$ schottky fabricated at moderate temperatures", E.L.H. Mayes, D.G. **McCulloch** and J.G. Partridge, *Applied Physics Letters*, **103**, 182101, 2013.
28. "The microstructure and mechanical properties of TiN-Ni nanocomposite thin films", A.M. Pagon, E.D. Doyle and D.G. **McCulloch**, *Surface and Coatings Technology*, **235**, 394, 2013.
29. "Characterization and device applications of ZnO films deposited by high power impulse magnetron sputtering (HiPIMS)", J.G. Partridge, E.H. Mayes, N.L. McDougall, M.M.M. Bilek and D.G. **McCulloch**, *J. Physics D: Applied Physics*, **46**, 165105, 2013.
30. "Hydrogen induced changes in the electrical resistance of oriented graphitic carbon films", A. Moafi, J. G. Partridge, A. Z. Sadek and D. G. **McCulloch**, *Journal of Materials Chemistry A*, **1**, 402, 2013.
31. "The anodized crystalline WO_3 nanoporous network with enhanced electrochromic properties", J.Z. Ou, S. Balendran, M.R. Field, D.G. **McCulloch**, A.S. Zoofakar, R.A. Rani, S. Zhuiykov, A.P. O'Mullane and L. Kalantar-zadeh, *Nanoscale*, **4**, 5980 (2012).
32. "Stable n-channel metal-semiconductor field effect transistors on ZnO films deposited using a filtered cathodic vacuum arc", S. Elzwawi, H-S. Kim, M. Lynam, E.L.H. Mayes, D.G. **McCulloch**, M.W. Allen and J.G. Partridge, *Applied Physics Letters*, **101**, 243503 (2012).
33. "Aluminium/aluminium oxide nanocomposites prepared using a filtered cathodic vacuum arc", N. Biluš Abaffy, D.G. **McCulloch** and J.G. Partridge, *Surface and Coatings Technology*, **207**, 529, 2012.
34. "Device quality ZnO grown using a Filtered Cathodic Vacuum Arc", S. Elzwawi, H.S. Kim, R. Heinhold, M. Lynam, G. Turner, J.G. Partridge, D.G. **McCulloch**, R.J. Reeves and M.W. Allen, *Physica B: Condensed Matter*, **407**, 2903, 2012.
35. "Lattice guiding for sputter deposition of single domain $(\text{Sr}(0.6)\text{Ba}(0.4))\text{Nb}(2)\text{O}(6)$ ferroelectric thin films", M. Bhaskaran, S.Sriram, B.J. Rodriguez, G.C. Devendra, K. Latham, D.G. **McCulloch**, and A. Mitchell, *Cryst. Eng. Comm.*, **14**, 359, 2012.
36. "Mechanism for the amorphisation of diamond", : B.A. Fairchild, S. Rubanov, D. Lau, M. Robinson, I. Suarez-Martinez, N. Marks, A.D. Greentree, D.G. **McCulloch** and S. Prawer, *Advanced Materials*, **24**, 2024, 2012.
37. "The interface structure of high performance ZnO Schottky diodes", E.L.H. Mayes, J.G. Partridge, M.R. Field, D.G. **McCulloch**, S.M. Durbin, H-S. Kim, and M.W. Allen, *Physica B: Condensed Matter*, **407**, 2867, 2012.
38. "The near edge structure of cubic boron nitride", D.G. **McCulloch**, D.W.M. Lau, R.J. Nicholls and J.M. Perkins, *Micron*, **43**, 43-48, 2011.
39. "Engineering titanium and aluminum oxide composites using atomic layer deposition", N. Biluš Abaffy, D.G. **McCulloch**, J.G. Partridge, P.J. Evans and G. Triani, *J. Applied Physics*, **110**, 123514, 2011.
40. "Controlled surface modification of boron nitride nanotubes", X.J.J. Dai, Y. Chen, Z.Q. Chen, P.R. Lamb, L.H. Li, J. du Plessis, D.G. **McCulloch** and X.G. Wang, *Nanotechnology*, **22**, 245301, 2011.
41. "The relationship between microstructure and electrical breakdown in cathodic arc deposited hafnium oxide films", M.R. Field, J.G. Partridge, E.H. Mayes, K. Latham and D.G. **McCulloch**, *J. Applied Physics*, **110**, 014108, 2011.
42. "SAW Gas Sensors with titania nanotube layers", M. Penza, A.Z. Sadek, H.D. Zheng, P. Aversa, D.G. **McCulloch**, K. Kalantar-zadeh and W. Wlodarski, *Sensor Letters*, **9**, 925-928, 2011.
43. "Facile, size-controlled deposition of highly dispersed gold nanoparticles on nitrogen carbon nanotubes for hydrogen sensing", A.Z. Sadeka, V. Bansala, D.G. **McCulloch**, P.G. Spizzirri, K. Latham, D.W.M. Lau, Z. Hud and K. Kalantar-zadeh, *Sensors and Actuators B: Chemical*, **160**, 1034-1042, 2011.
44. "Nitriding of high speed steel", E.D. Doyle, A.M. Pagon, P. Hubbard, S.J. Dowey, A. Pilkington, D.G. **McCulloch**, K. Latham and J. DuPlessis, *International Heat Treatment and Surface Engineering*, **5**, 69-72, 2011.
45. "Gas Sensing Properties of Interconnected ZnO Nanowires", M.B. Rahmani, M. Breedon, D. Lau, J.L.

- Campbell, A. Moafi, D.G. **McCulloch**, W. Wlodarski and K. Kourosh, *Sensor Letters*, **9**, 929-935, 2011.
46. "Energetic Deposition of Carbon in a Cathodic Vacuum Arc with a Biased Mesh", A. Moafi, D.W.M. Lau, A. Z. Sadek, J.G. Partridge, D.R. McKenzie and D. G. **McCulloch**, *J. Applied Physics*, **109**, 073309, 2011.
 47. "A hydrogen sensor based on graphitic carbon", A. Moafi, J. G. Partridge, A.Z. Sadek, D.W.M. Lau, K. Kalantar-zadeh, and D.G. **McCulloch**, *IEEE Sensors Journal*, **11**, 1913-1926, 2011.
 48. "The influence of deposition rate on the stress and microstructure of AlN films deposited from a filtered cathodic vacuum arc", M.B. Taylor, J.G. Partridge, D.G. **McCulloch**, M.M.M. Bilek and D.R. McKenzie, *Thin Solid Films*, **519**, 3573-3577, 2011.
 49. "SAW Gas Sensors with Metal Oxides Nanoplatelets Layers", M. Penza1, A.Z. Sadek, P. Aversa, D.G. **McCulloch**, W. Wlodarski and K. Kalantar-Zadeh, *Sensor Letters*, **9**, 920-924, 2011.
 50. "Controlled glow to arc transition in sputtering for high rate deposition of carbon films", M. Lattemann, B. Abendroth, A. Moafi, D.G. **McCulloch** and D.R. McKenzie, *Diamond and Related Materials*, **20**, 68-72, 2011.
 51. "HRMC_1.1: Hybrid Reverse Monte Carlo method with silicon and carbon potentials", G. Opletal, T.C. Petersen, B.O'Malley, I.K. Snook, D.G. **McCulloch** and I. Yarovsky, *Computer Physics Communications*, **182**, 542, 2011.
 52. "Corrosion of AA2024-T3 Part I: Localised corrosion of isolated IM particles", A. Boag, A.E. Hughes, A.M. Glenn, T.H. Muster and D. **McCulloch**, *Corrosion Science*, **53**, 17-26, 2011.
 53. "Corrosion of AA2024-T3 Part II: Co-operative corrosion", A.E. Hughes, A. Boag, A.M. Glenn, D. **McCulloch**, T.H. Muster, C. Ryan, C. Luo, X. Zhou and G.E. Thompson, *Corrosion Science*, **53**, 27-39, 2011.
 54. "A hydrogen gas sensor based on Pt/Nanostructured WO₃/SiC schottky diode", M. Shafiei, A.Z. Sadek, J. Yu, K. Latham, M. Breedon, D. **McCulloch**, K. Kalantar-zadeh and W. Wlodarski, *Sensor Letters*, **9**, 11-15, 2011.
 55. The effect of deposition energy on the microstructure and mechanical properties of high speed steel films prepared using a filtered cathodic vacuum arc", A.M. Pagon, J.G. Partridge, P. Hubbard, M.B. Taylor, D.G. **McCulloch**, E.D. Doyle, K. Latham, J.E. Bradby, K.B. Borisenko and G. Li, *Surface Coatings and Technology*, **204**, 3552-3558, 2010.
 56. "Energetic deposition of carbon clusters with preferred orientation using a new mixed mode cathodic arc - Sputtering process", M. Lattemann, A. Moafi, M.M.M. Bilek, D.G. **McCulloch** and D.R. McKenzie, *Carbon*, **48**, 918-921, 2010.
 57. "Ultraviolet and visible Raman analysis of thin a-C films grown by filtered cathodic arc deposition", J. Wasyluka, T.S. Perova, D.W.M. Lau, M.B. Taylor, D.G. **McCulloch** and J. Stopford, *Diamond & Related Materials*, **19**, 514-517, 2010.
 58. "Synthesis of Nanostructured Tungsten Oxide Thin Films: A Simple, Controllable, Inexpensive, Aqueous Sol-Gel Method", M. Breedon, P. Spizzirri, M. Taylor, J. du Plessis, D. **McCulloch**, J.M. Zhu, L.S. Yu, Z. Hu, C. Rix, W. Wlodarski and K. Kalantar-zadeh, *Crystal Growth & Design*, **10**, 430-439, 2010.
 59. "Uniformly Dispersed Pt-Ni Nanoparticles on Nitrogen-Doped Carbon Nanotubes for Hydrogen Sensing", A.Z. Sadek, C. Zhang, Z. Hu, J.G. Partridge, D.G. **McCulloch**, W. Wlodarski and K. Kalantar-zadeh, *J. Physical Chemistry C*, **114**, 238-242, 2010.
 60. "Energetic deposition of carbon clusters with preferred orientation using a new mixed mode cathodic arc – Sputtering process", M. Lattemann, A. Moafi, M.M.M. Bilek, D.G. **McCulloch** and D.R. McKenzie, *Carbon*, **48**, 918-921, 2010.
 61. "Investigation of nitrogen mass transfer within an industrial plasma nitriding system I: the role of surface deposits", P. Hubbard, J.G. Partridge, E.D. Doyle, D.G. **McCulloch**, M.B. Taylor and S.J. Dowey, *Surface Coatings and Technology*, **204**, 1145-1150, 2010.
 62. "Investigation of Nitrogen mass transfer within an Industrial plasma nitriding system II: Application of a biased screen", P. Hubbard, S.J. Dowey, J.G. Partridge, E.D. Doyle and D.G. **McCulloch**, *Surface Coatings and Technology*, **204**, 1151-1157, 2010.
 63. "Co-Operative Corrosion Phenomena" A. Hughes, T.H. Muster A. Boag, A.M. Glenn, C. Luo, X. Zhou, G.E. Thompson and D. **McCulloch**, *Corrosion Science*, **52**, 665-668, 2010.
 64. "Stable pit formation on AA2024-T3 in a NaCl environment", A. Boag, R.J. Taylor, T.H. Muster, N. Goodman, D. **McCulloch**, C. Ryan, B. Rout, D. Jamieson and A.E. Hughes, *Corrosion Science*, **52**, 90-103, 2010.