JES Classics

ECS Science at Its Best

by Krishnan Rajeshwar

The word "classic," according to *Webster's Dictionary*, has many connotations, all of them signifying something of the highest class: "of the highest quality or rank, having recognized and permanent value, of enduring interest and appeal, a work especially of literature, art, or music meriting the highest respect, particularly definitive, reliable, or authoritative or something regarded as perfect of its kind or fitting to serve as a model." Indeed all of these descriptors would apply aptly to the works and people featured in this special issue of the magazine celebrating the scientific contributions of ECS members. The seeds for such a celebratory issue of *Interface* were sown by Dan Scherson, Editor of the *Journal of The Electrochemical Society* (JES), at an Advisory Board meeting of this magazine not long ago. The various Divisions were then polled as to which specific JES paper had maximal impact on the technical activities of that particular group of scientists and engineers. Volunteers were then sought to write commentaries on these selected JES articles. The first set of such perspectives appear in the pages that follow.

While the choice of specific impact papers necessarily has a subjective element to it, the Divisional membership were furnished with a list of the most-cited JES articles from the ISI Web of Science to aid in their "pick"—this compilation is presented here in abbreviated format. Also of interest are top-cited authors, institutions, and countries where these works originated from—these also accompany this introduction. I would like to thank Prashant Kamat for these data and analyses.

It was also felt that it would be entirely appropriate to include, in this issue, a story on winners of the National Medal of Technology & Innovation who have had affiliations with ECS. Three recent laureates of the medal, Adam Heller, Grant Willson, and Jerry Woodall are profiled in the pages that follow.

One cannot but help being impressed by the overall quality and collective impact of all the works highlighted in this special issue of the magazine. They are "classics" in every sense of the word. Indeed, The Electrochemical Society should be proud to have these outstanding and influential scientists as members. Read on and enjoy.

Krishnan Rajeshwar is the Editor of Interface. *He is a Distinguished University Professor and Associate Dean of the College of Science at the University of Texas, Arlington.*

TOP 100

Most Cited Papers from JES

All papers are from the *Journal of The Electrochemical Society* (JES).

Papers with 1,000+ Citations

1. A. Ishizaka and Y. Shiraki, "Low-Temperature Surface Cleaning of Silicon and Its Application to Silicon MBE," **133**, 666 (1986).
2. M. Stern and A. L. Geary, "Electrochemical Polarization. 1. Theoretical Analysis of the Shape of Polarization Curves," **104**, 56 (1957).

Papers with 500+ Citations

3. T. E. Springer, T. A. Zawodzinski, and S. Gottesfeld, "Polymer Electrolyte Fuel-Cell Model," **138**, 2334 (1991).
4. A. K. Padhi, K. S. Nanjundaswamy, and J. B. Goodenough, "Phospho-olivines as Positive-Electrode Materials for Rechargeable Lithium Batteries," **144**, 1188 (1997).
5. K. Kiukkola and C. Wagner, "Measurements on Galvanic Cells Involving Solid Electrolytes," **104**, 379 (1957).
6. F. Keller, M. S. Hunter, and D. L. Robinson, "Structural Features of Oxide Coatings on Aluminum," **100**, 411 (1953).
7. C. Ho, I. D. Raistrick, and R. A. Huggins, "Application of AC Techniques to the Study of Lithium Diffusion in Tungsten Trioxide Thin-Films," **127**, 343 (1980).
8. T. Ohzuku, M. Kitagawa, and T. Hirai, "Electrochemistry of Manganese-Dioxide in Lithium Nonaqueous Cell. 3. X-Ray Diffractional Study on the Reduction of Spinel-Related Manganese Dioxide," **137**, 769 (1990).
9. D. M. Bernardi and M. W. Verbrugge, "A Mathematical-Model of the Solid-Polymer-Electrolyte Fuel-Cell," **139**, 2477 (1992).
10. J. M. Tarascon, E. Wang, F. K. Shokoohi, W. R. McKinnon, and S. Colson, "The Spinel Phase of $LiMn_2O_4$ as a Cathode in Secondary Lithium Cells," **138**, 2859 (1991).
11. H. Seidel, L. Csepregi, A. Heuberger, and H. Baumgartel, "Anisotropic Etching of Crystalline Silicon in Alkaline-Solutions. 1. Orientation Dependence and Behavior of Passivation Layers," **137**, 3612 (1990).
12. R. Fong, U. Vonsacken, and J. R. Dahn, "Studies of Lithium Intercalation into Carbons Using Nonaqueous Electrochemical-Cells," **137**, 2009 (1990).
13. J. N. Reimers and J. R. Dahn, "Electrochemical and In Situ X-Ray Diffraction Studies of Lithium Intercalation in Li_xCoO_2," **139**, 2091 (1992).
14. B. E. Conway, "Transition from Supercapacitor to Battery Behavior in Electrochemical Energy Storage," **138**, 1539 (1991).

Papers with 250+ Citations

15. J. P. Zheng, P. J. Cygan, and T. R. Jow, "Hydrous Ruthenium Oxide as an Electrode Material for Electrochemical Capacitors," **142**, 2699 (1995).
16. T. A. Zawodzinski, C. Derouin, S. Radzinski, R. J. Sherman, V. T. Smith, T. E. Springer, and S. Gottesfeld, "Water-Uptake by and Transport Through Nafion® Membranes," **140**, 1041 (1993).

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Most Cited Papers from JES

17. B. E. Deal, M. Sklar, A. S. Grove, and E. H. Snow, "Characteristics of Surface-State Charge (QSS) of Thermally Oxidized Silicon," **114**, 266 (1967).
18. I. A. Courtney and J. R. Dahn, "Electrochemical and In Situ X-Ray Diffraction Studies of the Reaction of Lithium with Tin Oxide Composites," **144**, 2045 (1997).
19. J. M. Tarascon, W. R. McKinnon, F. Coowar, T. N. Bowmer, G. Amatucci, and D. Guyomard, "Synthesis Conditions and Oxygen Stoichiometry Effects on Li Insertion into the Spinel $LiMn_2O_4$," **141**, 1421 (1994).
20. C. C. Liang, "Conduction Characteristics of Lithium Iodide Aluminum Oxide Solid Electrolytes," **120**, 1289 (1973).
21. T. Ohzuku, A. Ueda, and M. Nagayama, "Electrochemistry and Structural Chemistry of $LiNiO_2$ (R3M) for 4 Volt Secondary Lithium Cells," **140**, 1862 (1993).
22. D. R. Turner, "Electropolishing Silicon in Hydrofluoric Acid Solutions," **105**, 402 (1958).
23. J. Newman, "Resistance for Flow of Current to a Disk," **113**, 501 (1966).
24. C. D. Thurmond, "Standard Thermodynamic Functions for Formation of Electrons and Holes in Ge, Si, GaAs, and GaP," **122**, 1133 (1975).
25. W. Weppner and R. A. Huggins, "Determination of Kinetic-Parameters of Mixed-Conducting Electrodes and Application to System Li_3SB," **124**, 1569 (1977).
26. T. V. Nguyen and R. E. White, "A Water and Heat Management Model for Proton-Exchange-Membrane Fuel Cells," **140**, 2178 (1993).
27. A. Yamada, S. C. Chung, and K. Hinokuma, "Optimized $LiFePO_4$ for Lithium Battery Cathodes," **148**, A224 (2001).
28. D. Guyomard and J. M. Tarascon, "Li Metal-free Rechargeable $LiMn_2O_4$/Carbon Cells—Their Understanding and Optimization," **139**, 937 (1992).
29. V. Lehmann and H. Foll, "Formation Mechanism and Properties of Electrochemically Etched Trenches in n-Type Silicon," **137**, 653 (1990).
30. E. Peled, "The Electrochemical-Behavior of Alkali and Alkaline-Earth Metals in Non-Aqueous Battery Systems—The Solid Electrolyte Interphase Model," **126**, 2047 (1979).
31. T. Matsuzawa, Y. Aoki, N. Takeuchi, and Y. Murayama, "New Long Phosphorescent Phosphor with High Brightness, $SrAl_2O_4:Eu^{2+},Dy^{3+}$," **143**, 2670 (1996).
32. W. A. Pliskin and H. S. Lehman, "Structural Evaluation of Silicon Oxide Films," **112**, 1013 (1965).
33. C. J. Wen, B. A. Boukamp, R. A. Huggins, and W. Weppner, "Thermodynamic and Mass-Transport Properties of LiAl," **126**, 2258 (1979).
34. M. S. Whittingham, "Role of Ternary Phases in Cathode Reactions," **123**, 315 (1976).
35. V. Lehmann, "The Physics of Macropore Formation in Low Doped n-Type Silicon," **140**, 2836 (1993).
36. R. Chen, "Glow Curves with General Order Kinetics," **116**, 1254 (1969).
37. M. Nagayama and M. Cohen, "The Anodic Oxidation of Iron in a Neutral Solution. 1. The Nature and Composition of the Passive Film," **109**, 781 (1962).
38. X. Y. Xia, Y. H. Zhou, and M. Yoshio, "Capacity Fading on Cycling of 4V Li/$LiMn_2O_4$ Cells," **144**, 2593 (1997).
39. H. P. Leckie and H. H. Uhlig, "Environmental Factors Affecting Critical Potential for Pitting in 18-8 Stainless Steel," **113**, 1262 (1966).
40. R. A. Bull, F. R. F. Fan, and A. J. Bard, "Polymer-Films on Electrodes. 7. Electrochemical-Behavior at Polypyrrole-Coated Platinum and Tantalum Electrodes," **129**, 1009 (1982).
41. J. R. Dahn, U. Vonsacken, M. W. Juzkow, and H. Aljanaby, "Rechargeable $LiNiO_2$ Carbon Cells," **138**, 2207 (1991).
42. H. A. Gasteiger, N. Markovic, P. N. Ross, and E. J. Cairns, "Temperature-Dependent Methanol Electro-oxidation on Well-Characterized Pt-Ru Alloys," **141**, 1795 (1994).
43. V. D. Neff, "Electrochemical Oxidation and Reduction of Thin-Films of Prussian Blue," **125**, 886 (1978).
44. H. L. Yeager and A. Steck, "Cation and Water Diffusion in Nafion Ion-Exchange Membranes—Influence of Polymer Structure," **128**, 1880 (1981).
45. C. Y. Chao, L. F. Lin, and D. D. Macdonald, "A Point-Defect Model for Anodic Passive Films. 1. Film Growth-Kinetics," **128**, 1187 (1981).
46. T. Ohzuku and A. Ueda, "Solid-State Redox Reactions of $LiCoO_2$ (R3M) for 4 Volt Secondary Lithium Cells," **141**, 2972 (1994).
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48. N. Papageorgiou, Y. Athanassov, M. Armand, P. Bonhote, H. Pettersson, A. Azam, and M. Gratzel, "The Performance and Stability of Ambient Temperature Molten Salts for Solar Applications," **143**, 3099 (1996).
49. R. Herino, G. Bomchil, K. Barla, C. Bertrand, and J. L. Ginoux, "Porosity and Pore-Size Distributions of Porous Silicon Layers," **134**, 1994 (1987).
50. T. F. Fuller and J. Newman, "Water and Thermal Management in Solid-Polymer-Electrolyte Fuel-Cells," **140**, 1218 (1993).
51. W. Kern, "The Evolution of Silicon-Wafer Cleaning Technology," **137**, 1887 (1990).
52. K. M. Abraham and M. Alamgir, "Li^+-Conductive Solid Polymer Electrolytes with Liquid-like Conductivity," **137**, 1657 (1990).
53. D. W. Deberry, "Modification of the Electrochemical and Corrosion Behavior of Stanless-Steels with an Electroactive Coating," **132**, 1022 (1985).
54. M. A. Butler and D. S. Ginley, "Prediction of Flatband Potentials at Semiconductor-Electrolyte Interfaces from Atomic Electronegativities," **125**, 228 (1978).
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56. D. E. Stilwell and S. M. Park, "Electrochemistry of Conductive Polymers. 2. Electrochemical Studies on Growth-Properties of Polyaniline," **135**, 2254 (1988).
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58. A. B. McEwen, H. L. Ngo, K. LeCompte, and J. L. Goldman, "Electrochemical Properties of Imidazolium Salt Electrolytes for Electrochemical Capacitor Applications," **146**, 1687 (1999).
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60. M. E. Coltrin, R. J. Kee, and J. A. Miller, "A Mathematical-Model of the Coupled Fluid-Mechanics and Chemical-Kinetics in a Chemical Vapor-Deposition Reactor," **131**, 425 (1984).

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62. H. W. Pickering and C. Wagner, "Electrolytic Dissolution of Binary Alloys Containing a Noble Metal," **114**, 698 (1967).
63. D. D. Macdonald, "The Point-Defect Model for the Passive State," **139**, 3434 (1992).
64. I. A. Courtney and J. R. Dahn, "Key Factors Controlling the Reversibility of the Reaction of Lithium with SnO_2 and Sn_2BPO_6 Glass," **144**, 2943 (1997).
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67. M. P. R. Panicker, M. Knaster, and F. A. Kroger, "Cathodic Deposition of CdTe from Aqueous-Electrolytes," **125**, 566 (1978).
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74. S. Um, C. Y. Wang, and K. S. Chen, "Computational Fluid Dynamics Modeling of Proton Exchange Membrane Fuel Cells," **147**, 4485 (2000).
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97. H. C. Gatos and M. C. Lavine, "Characteristics of the (111) Surfaces of the III-V Intermetallic Compounds," **107**, 427 (1960).
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99. D. Aurbach, Y. Eineli, O. Chusid, Y. Carmeli, M. Babai, and H. Yamin, "The Correlation Between the Surface-Chemistry and the Performance of Li-Carbon Intercalation Anodes for Rechargeable Rocking-Chair Type Batteries," **141**, 603 (1994).
100. K. Kinoshita, "Particle-Size Effects for Oxygen Reduction on Highly Dispersed Platinum in Acid Electrolytes," **137**, 845 (1990).

TOP 20

Countries with the Most Papers Published in JES

Country	Number of Articles Published	Percentage of All Articles Published in JES
1. United States	23,697	43.1%
2. Japan	5,467	9.0%
3. Canada	1,836	3.3%
4. France	1,739	3.2%
5. Germany	1,440	2.6%
6. England	1,153	2.1%
7. Taiwan	1,057	1.9%
8. South Korea	1,026	1.9%
9. China	638	1.2%
10. Italy	635	1.2%
11. The Netherlands	586	1.1%
12. Sweden	462	0.8%
13. Israel	420	0.8%
14. Switzerland	420	0.8%
15. Belgium	402	0.7%
16. India	353	0.6%
17. Spain	325	0.6%
18 Australia	235	0.4%
19. Brazil	201	0.4%
20. Singapore	181	0.3%

TOP 20

Institutions with the Most Papers Published in JES

Institution	Number of Articles Published	Percentage of All Articles Published in JES
1. IBM Corp.	1,545	2.8%
2. Bell Labs	1,384	2.5%
3. Univ. California, Berkeley	566	1.0%
4. MIT	548	1.0%
5. U.S. Naval Res. Lab.	544	1.0%
6. Argonne National Lab	521	1.0%
7. GE	515	1.0%
8. Stanford Univ.	477	0.9%
9. Hitachi Ltd.	410	0.7%
10. Univ. of Illinois	386	0.7%
11. Penn State Univ.	382	0.7%
12. Case Western Reserve Univ.	371	0.7%
13. Sandia National Labs	362	0.7%
14. Univ. of Texas	360	0.7%
15. Kyoto Univ.	341	0.6%
16. CNRS	334	0.6%
17. Tohoku Univ.	318	0.6%
18. Brookhaven National Lab	307	0.6%
19. Philips Research Labs	293	0.5%
20. N. Carolina State Univ.	288	0.5%

TOP 25

Most Prolific Authors in JES

Author	Number of Articles Published	Percentage of All Articles Published in JES
1. Newman, J. S.	206	0.37%
2. White, R. E.	189	0.34%
3. Dahn, J. R.	160	0.29%
4. Yeager, E.	148	0.27%
5. Bard, A. J.	137	0.25%
6. Tobias, C. W.	130	0.24%
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8. Gatos, H. C.	114	0.21%
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24. Smyrl, W. H.	94	0.17%
25. Wagner, J. B.	94	0.17%

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