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OBITUARY

S.G. Whiteway (1927-2001)

Dr. Stirling G. Whiteway, who died 23 October 2001, was born in 1927 in Stellarton, Nova Scotia. In 1944 he won the Hector McInnes Memorial Scholarship to read science at Dalhousie University, graduating in 1947 after majoring in chemistry. The following year he obtained a National Research Council (NRC) post-graduate bursary and a diploma in chemical engineering. The bursary was extended to 1949 during which he earned the degree of M.Sc. in physical chemistry. He then won a National Research Council overseas science research scholarship to be held under E.K. Rideal at the Royal Institution in London, U.K. but shortly afterwards Rideal moved to Cambridge and Whiteway returned to Canada to work with S.G. Mason at McGill University, where he obtained a National Research Council Fellowship which supported his studies for the degree of Ph.D. He moved to N.R.C. in Ottawa in 1952 to take up a post-doctoral fellow appointment. Shortly afterwards, in 1953, he returned to Nova Scotia to join the National Research Council Laboratory in Halifax. He became Principal Research Officer and was Head of the Industrial Materials Section which managed national programs in coal and ceramic research and included collaboration with industries such as Sydney Steel. He retired from NRC in 1989. Dr. Whiteway was elected to membership in the Nova Scotian Institute of Science (NSIS) in 1947 and was a Life Member. In addition he was a fellow of the Canadian Institute of Chemistry and a member of many other societies including the Canadian Institute of Mining, Metallurgy and Petroleum, American Ceramic Society, Canadian Ceramic Society and Sigma Xi (The Scientific Research Society). He served on Natural Sciences and Engineering Research Council granting committees for six years.

Originally appointed an adjunct Professor at the Technical University of Nova Scotia (TUNS) in 1985 in the Department of Mining and Metallurgical Engineering, he was reappointed in 1990 for consecutive three-year periods, most recently in the Faculty of Engineering (formerly TUNS), Dalhousie University. During this period he taught undergraduate and graduate courses and supervised numerous undergraduate theses.

His first contribution (in association with Professor C.C. Coffin and others) to the NSIS occurred in December 1947 when he demonstrated the experimental measurement of ^{32}P (half-life 14 d, β^-1.71 Mev). The technique was used (Proc. N.S. Inst. Sci., 22(3):42) to measure the uptake of the radionucleide by organisms in an acid bog-lake and has been used by molecular biologists ever since. Also under Coffin, in a similar vein, he studied the diffusion of silver nitrate and Ag^+ in aqueous solution using $^{110}Ag^+$ (250 d. β^- 0.53 Mev, γ 0.9 Mev) as a marker for the cation. This experimental work reveals two of Whiteway's extraordinary skills – his ability to handle safely very hazardous materials and a numerical and algebraic talent – both of which were manifest throughout his career.

His work with Mason at McGill University solved many discrepant results in the literature on the liquid vapour coexistence curves of ethane, ethylene and xenon. It was shown that these discrepancies were mostly due to impurities and agitation. There was therefore good agreement that a major contributor to the "flat-top effect" was gravitational compression.

The very productive collaboration between C.R. Masson and Whiteway in photochemistry, studies of gas-metal systems e.g. the use of levitation to determine the solubility of oxygen in iron at 1800-1900° and the development of a theory of the proportion of oligomers in polymerization reactions were described in Whiteway's contribution to the obituary of C.R. Masson (Proc. N.S. Inst. Sci., 38:189-197), with one notable exception – Whiteway's development of Pascal's triangle for calculating the probabilities of such size distributions. This early example of fuzzy logic (Furuhashi and Uchikawa, 1995) underpinned the intellectual controversies stimulated by Masson, and led to a greater understanding of the chemistry of metallurgical slags.

Whiteway's commitment to public service was exemplified by his contribution to the effort in 1970 by many Canadian scientists and engineers to understand and mitigate the effects of a major spill of "Bunker C" oil into Chedabucto Bay, Nova Scotia.

In the late 1970s Whiteway's interests tended to concentrate on the chemistry of the transformation of coal and iron ore into steel. His description of this chemistry (Proc. N.S. Inst. Sci., 30:67-87) is an authoritative and lucid contribution to our knowledge of the subject and, indeed, the status of the industry in 1980. It would be presumptuous to attempt to summarize this account because it does not necessarily draw attention to the ingenious solutions to the problems of studying chemistry on a laboratory scale at temperatures in the region 1000-2000^o. The use of levitation has been mentioned, but not its application to the measurement of the activity coefficients of ferrous oxide in equilibrated iron-ferrous oxide-silicon dioxide melts at $\approx$1900^o. Another notable contribution to high temperature chemistry was the fabrication of ceramic vessels by slip-casting techniques, and studies of their corrosion at elevated temperatures, resistance to thermal shock, abrasion and the relationship between particle size (studied by scanning electron microscopy) and their development of microcracks.

In Whiteway's review of the steel industry he mentions the discovery of transition metal sulfides in coal seams in Cape Breton. Work on these particles ($\approx$20 μm) became part of a general investigation of the changes occurring in the conversion of coal into coke (char). These investigations included the effect of temperature and reduced pressure on the process. The use of "free fall" stainless steel (600 cm high) and quartz (140 cm) reactors was used to determine the production under different conditions of hydrogen, carbon oxides and hydrocarbons. The very complex chemistry of the decomposition of the iron sulfide occlusions was not described in detail. It was shown that the crystalline material (marcasite) was more stable at $\approx$500^o than the pyritic amorphous material and that the sulfur liberated was found partly in the coal tar.

Towards the end of his career, Whiteway returned to problems of diffusion, in particular the diffusion of hydrogen in steel. The subject is of theoretical interest and industrial importance. For example, the mechanical integrity of steel rail used in railroad construction is dependent in part on the hydrogen content of the steel developed during its manufacture. Whiteway and his collaborators constructed an apparatus, fabricated in part from steel rail produced in the mill in Sydney, Nova Scotia, which permitted the study of hydrogen diffusion and "solubility" in steels. It was found for example that the solubility of hydrogen in a steel containing 0.7% carbon, 0.8% manganese and 0.5% silicon at 1000^o was 1.9 μg cm^{-3} and at 770^o 0.5 μg cm^{-3}, and that the diffusivity over the same temperature range of the same sample was virtually unchanged at $10^{-3.7}$ cm^2 s^{-1}. The figures are given to illustrate the sensitivity and precision of the method which was materially assisted by a general solution of the partial differential equations involved, by Whiteway's son. Whiteway notes in these publications that "the diffusivity of an atom in a solid is a fundamental property which reflects the mobility of the atom and the structure of the host matrix". This fundamental property has become of increasing importance in many fields of chemistry from the diffusion of ions through nafion membranes in the industrial manufacture of caustic soda (Vaughan, 1973; Ramp, 1976), to the migration of activated amino acids in channels of polyribosyl phosphates (Nissen et al., 2000). We must hope that in Pasternak's beautiful words: "(For) others will surely follow/The living imprint of your feet".

For almost 50 years Stirling Whiteway and his wife provided fine hospitality, encouragement and help to many students, post-doctorate fellows and friends, many of whom are now dispersed in different parts of the world. An example of this hospitality and other interests may be found in his last publication in these Proceedings (Proc. N.S. Inst. Sci., 40:59-60). We are proud to have known him and offer our sincere condolences to his wife and family.

References

Furuhashi T, Uchikawa Y (1995) Fuzzy logic, neural networks and evolutionary computation. IEEE/Nagoya University, World Wisepersons Workshop, Nagoya, Springer, Tokyo

Nissen P, Hansen J, Nenad B, Moore PB, Steitz TA (2000) The structural basis of ribosome activity in peptide bond synthesis. Science 289:920-930

Ramp FL (1976) Electolysis process producing chlorine at the anodes and alkali metal hydroxide at the cathodes. Ger Offen 2624202; Chem Abst 86:80914

Vaughan DJ (1973) Nafion an electrochemical traffic controller. Du Pont Innovation 4:10-13; Chem Abst 79:48623

Publications of SG Whiteway

Coffin CC, Hayes FR, Jodrey LH, Whiteway SG (1948) Exchange of materials in a lake as studied by the addition of radioactive phosphorus. Proc NS Inst Sci 22:42

Coffin CC, Hayes FR, Jodrey LH, Whiteway SG (1949) Exchange of materials in a lake as studied by radioactive phosphorus. Nature (Lond.) 163:963-964

Coffin CC, Hayes FR, Jodrey LH, Whiteway SG (1949) Exchange of materials in a lake as studied by the addition of radioactive phosphorus. Can J Res 27D:207-222

Whiteway SG, MacLennan DF, Coffin CC (1950) The diffusion of $AgNO_3$ and of Ag^+ in aqueous solution. J Chem Phys 18:229-230

Whiteway SG, Mason SG (1953) Coexistance phenomena in the critical region. II. Influence of gravity on the coexistance curves of ethane, ethylene and xenon. Can J Chem 31:569-584

Whiteway SG, Masson CR (1954) Direct current power supply for AH-6 mercury arcs. Can J Chem 32:1154-1155

Whiteway SG, Masson CR (1955) The carbon monoxide quantum yield in the photolysis of diisoproplketone. J Am Chem Soc 77:1508-1509

Whiteway SG, Masson CR (1956) Rates of association of *n*-propyl radicals. J Chem Phys 25:233-237

Whiteway SG (1960) Measurement of low permeability in ceramic test pieces. Am Ceram Soc Bull 39:677-679

Whiteway SG (1961) Measurement of low permeability in ceramic test pieces. Proc NS Inst Sci 25:209

Whiteway SG, Coll-Palagos M, Masson CR (1961) Slip casting magnesia. Am Ceram Soc Bull 40:432-438

Whiteway SG (1962) Sintering long thermocouple sheaths without warping. Am Ceram Soc Bull 41:95

Whiteway SG (1963) Density and permeability of sintered slip-cast magnesia. J Am Ceram Soc 46:215-218
Masson CR, Whiteway SG, Collings CA (1964) Slip casting calcium fluoride and lime stabilized zirconia. Am Ceram Soc Bull 42:745-747
Peters RJW, Masson CR, Whiteway SG (1965) Kinetics of desulphurization of liquid iron-sulphur alloys by mixtures of hydrogen with helium and argon. Trans Farad Soc 61:1745-1753
Whiteway SG, Masson CR (1966) Effect of thermionic emission on electrochemical measurements at high temperatures. Can J Chem 44:2421-2427
Masson CR, Whiteway SG, Jamieson WD, Collings CA (1966) Determination of oxygen in titanium by isotopic dilution. Can Met Quart 5:329-341
Masson CR, Whiteway SG (1967) Diffusion of oxygen in liquid silver by an electrochemical method. Can Met Quart 6:199-217
Cameron J, Whiteway SG (1968) Preparation of deoxidized iron-sulphur alloys. Can Met Quart 7:153-155
Kojima H, Whiteway SG, Masson CR (1968) Melting points of inorganic fluorides. Can J Chem 46:2968-2971
Whiteway SG, Peters RJW, Jamieson WD, Masson CR (1968) Decarburization of iron-carbon alloys by argon-oxygen mixtures. Can Met Quart 7:211-215
Whiteway SG (1970) Modification of Pascal triangle for calculating size distribution in polymers. Can J Chem 48:1432-1435
Distin PA, Whiteway SG (1970) Kinetics of vaporization and oxidation of liquid iron levitated in flowing helium-oxygen. Can Met Quart 9:419-426
Whiteway SG, Smith IB, Masson CR (1970) Theory of molecular size distribution in multichain polymers. Can J Chem 48:33-45
Masson CR, Smith IB, Whiteway SG (1970) Molecular size distributions in multichain polymers: application of polymer theory to silicate melts. Can J Chem 48:201-202
Masson CR, Smith IB, Whiteway SG (1970) Activities and ionic distributions in liquid silicates: application of polymer theory. Can J Chem 48:1456-1464
Masson CR, Whiteway SG (1970) Discussion of "Electrochemical measurement of oxygen diffusivity in liquid silver". Met Trans 1:2333-2334
Whiteway SG (1970) Laboratory trials on applying powders to "Gloop" [Spilled Bunker "C" oil]. Atlantic Regional Laboratory Technical Report No 2
Whiteway SG (1970) Polyurethane foamed onto Bunker "C" water emulsion as absorbant. Atlantic Regional Laboratory Technical Report No 3
Whiteway SG (1971) Kinetics of reactions between gases and molten alloys of iron. Can Metal Quart 10:185-187
Distin PA, Whiteway SG, Masson CR (1971) Solubility of oxygen in liquid iron from 1785° to 1961°. A new technique for the study of slag-metal equilibria. Can Met Quart 10:13-18
Distin PA, Whiteway SG, Masson CR (1971) Thermodynamics and constitution of ferrous silicate melts. Can Met Quart 10:73-78
Masson CR, Smith IB, Whiteway SG (1971) Reply to Gordon and Judd. Nature (Lond.) 234:97-98
Whiteway SG, Jamieson WD (1972) Laboratory trials on applying powders to "Gloop", Part II. Atlantic Regional Laboratory Technical Report No 11
Cameron J, Whiteway SG (1973) Effect of silicon on the rate of desulfurization of liquid iron-sulphur alloys by argon-hydrogen at 1550°. Can Metal Quart 12:289-293
Hayer M, Whiteway SG (1973) Effect of sulphur on the rate of decarburization of molten iron. Can Met Quart 12:35-44

Hayer M, Whiteway SG (1973) Preparation of iron-carbon-sulphur alloys. Can Met Quart 12:217-218

Kazi A, Whiteway SG (1973) Effect of strontium oxide on the desulfurizing power of slags. In: Gray TJ (ed) Proc Int Conf Strontium containing compounds. Atlantic Industrial Research Inst, Halifax, Nova Scotia, Part 2: 111-118; Can Met Quart 12:435-438

Whiteway SG, Smith IB, Masson CR (1973) Theory of molecular size distribution in multichain polymers: condensation of R-A_f with R′A_f and R-A_f with R′-A_f′. Can J Chem 51:1422-1431

Kazi A, Whiteway SG (1974) Viscometer for molten oxidizing slags. Can Met Quart 13:669-670

Masson CR, Whiteway SG (1974) Reply to comment: on the Whiteway-Smith-Masson and Florey-Stockmayer theories of polymerization. Can J Chem 52:1190-1191

Whiteway SG, Sakawa M, Murphy G (1975) Oxygen gradient in the diffusion layer above graphite undergoing oxidation at 1425ºC. Can Met Quart 14:31-35

Sakawa M, Whiteway SG, Masson CR (1976) Activities of FeO in the ternary system SiO_2-MgO-FeO and constitution of SiO_2. Tetsu to Hagane 62:176-181; Translated (1978) Iron Steel Inst Jpn 18:173-176

Caley WF , Whiteway SG, Neil AB, Dugdale PJ (1977) Viscometer for lead blast furnace slags. Can Met Quart 16:1-4

Caley WF, Whiteway SG (1978) Viscosity of a copper reverberatory slag. Atlantic Research Laboratory Technical Report No 22

Whiteway SG, Galves I (1978) The equilibrium between sulfur in coal and coke oven gas. In: Hancock HA (ed) Proc Coal Coke Sess, Can Chem Eng Conf, 28th. Can Soc Chem Eng, Ottawa, p 73-77

Whiteway SG, Galves I (1978) The desulfurization of coal during coking by the injection of sulfur-free coke oven gas. In: Hancock HA (ed) Proc Coal Coke Sess, Can Chem Eng Conf, 28th. Can Soc Chem Eng, Ottawa, p 78-87

Whiteway SG, Caley WF (1979) Direction of coal research in Eastern Canada: proceedings of a workshop jointly sponsored by the Atlantic group for research in industrial metallurgy and the National Research Council of Canada. Atlantic Regional Laboratory Technical Report No 25

Whiteway SG (1979) Kinetics of decarburization of molten iron-carbon by gaseous hydrogen. Can J Chem Eng 57:78-82

Whiteway SG (1980) Research and development in the steel industry in Nova Scotia. Proc NS Inst Sci 30:67-87

Caley WF, Whiteway SG, Dugdale PJ, Galves I (1980) Occurrences of silver-zinc alloys in the desilvering of lead bullion. Can Met Quart 19:201-213

Iyer KJL, Ramachandran EG, Whiteway SG (1980) Stabilization of austenite by atomic hydrogen. Curr Sci 49:470

Kazi A, Whiteway SG (1982) Erosion resistant ceramics for coal utilization: a report. Atlantic Research Laboratory Technical Report No 31

Whiteway SG, Caley WF, Iyer L, Holmes V (1983) Permeability, solubility and diffusivity of hydrogen in carbon and alloy rail steel at 500-600^o. Can Met Quart 22:341-345

Stewart I, Whiteway SG, Cleyle PJ, Caley WF (1984) Decomposition of pyrite in a coal matrix during the pyrolysis of coal. Prepr Pap Am Chem Soc, Div Fuel Chem 29:341-346

Cleyle PJ, Caley WF, Stewart I, Whiteway SG (1984) Decomposition of pyrite and trapping of sulphur in a coal matrix during pyrolysis of coal. Fuel 63:1579-1582

Whiteway SG, Caley WF, Peill J (1985) Deterioration of materials in a quarter-megawatt straw burner. Proc NS Inst Sci 35:55-65

Hirajima T, Chan E, Whiteway SG (1986) Vacuum and atmospheric pressure TGA on an eastern Canadian coal. Fuel 65:844-848

Whiteway SG, Chan EW, Kazi A (1986) Erosion and thermal shock tests on ceramic materials. Can J Chem Eng 64:305-310

Whiteway SG, Chan EW, Morphy DD, Kazi A (1986) Resistance to abrasion and thermal shock in transformation-toughened alumina. J Can Ceram Soc 55:28-33

Stewart I, Whiteway SG, Cleyle PJ, Caley WF (1986) Decomposition of pyrite in a coal matrix during the pyrolysis of coal. In: Vorres KS (ed) Mineral matter and ash in coal. Am Chem Soc Symposium Series No 301:385-399

Hirajima T, Chan E, Whiteway SG, Stefanski M, Stewart I (1987) Benefication of char, from a pyrolized eastern Canadian coal, by aggregative flotation. Coal Preparation 5:85-108

Kazi A, Marple B, Whiteway SG (1987) Resistance to abrasion and thermal shock in transformation-toughened alumina. II Comparative performance of various powders. Can Ceram Quart 56:33-38

Caley WF, Whiteway SG (1988) Corrosion of refractory materials by liquid slags formed from the combustion of straw. Can Metal Quart 27:135-140

Whiteway SG, Stewart I, Chan E, Caley WF, Adorjan LA (1988) Pyrolysis/magnetic separation: a process for reducing the sulphur content of eastern Canadian coals. Proc NS Inst Sci 38:9-22

Caley WF, Whiteway SG, Stewart I (1989) Variation of reactivity of iron disulfide in eastern Canadian coal as function of morphology. Coal Preparation 7:37-46

Konsztowicz KJ, Whiteway SG, Glennie D (1989) Effects of agglomeration on the casting behaviour of dense aqueous suspensions of alumina/zirconia. In: Mostaghaci H (ed) Process Ceram Met Matrix Compos, Proc Int Symp. Pergamon, New York, p 58-68

Bilgesu A, Whiteway SG (1990) Rapid pyrolysis of eastern Canadian coals by free fall reactors. Fuel Sci Technol Int 8:491-505

Caley WF, Whiteway SG (1990) The measurement of diffusion coefficients in solids at elevated temperatures: hydrogen in steel. Can Met Quart 29:319-323

Konsztowicz KJ, Whiteway SG (1990) Processing contributions to microcrack formation in ZTA composites. Ceram Eng Sci Proc 11:1405-1422

Whiteway SG, Caley WF (1992) Chemical metallurgy at the Halifax laboratory of the National Research Council, 1954-1986. In: History, National Research Council, Canada. CIM, Montreal, p 78-82

Whiteway SG, Caley WF, Maclean JR (1995) A note on an optical phenomenon at the surface of liquid metals. Can Met Quart 34:373-375

Whiteway SG, McCulloch AW (1995) Migration of *Salvelinus fontinalis* in relation to the date of spring thaw (ice-out) of Eight Island Lake, Guysborough County, Nova Scotia. Proc NS Inst Sci 40:59-60

Whiteway SG, Caley WF (1997) Optical phenomenon at the surface of metals: a reply to Sun and Jahanshahi. Can Met Quart 36:223

Caley WF, Prest C, MacDonald JB, Whiteway SG (2002) Influence of plate composition on clogging of tundish plates. Can Met Quart 41:205-212