History of the Electrostatic Processes Committee

G. S. PETER CASTLE, SENIOR MEMBER, IEEE

INTRODUCTION

ELECTROSTATIC processes can no doubt lay claim to having the oldest technology of any group in the Industry Application Society (IAS) in the sense that electrostatics is one of the earliest of the sciences to be identified, with origins several thousand years prior to the founding of the Society itself. It is perhaps because of this very long history that many engineers do not fully understand or appreciate the fact that the discipline of applied electrostatics has evolved dramatically during this current century.

For many the term electrostatics still brings to mind visions of the quaint high school experiment in which one, donning the mantle of that historical Greek, methodically rubs a carefully preserved square of cat's fur on a specially labeled piece of amber. Perhaps more enlightened experiments actually used the modern equivalents of synthetic fabric and plastic to show that electrical activity is present in even greater quantities today. As a further extension one could show the economic significance of this experiment if the resulting spark is directed in close proximity to an electronic calculator or other such devices containing very large-scale integrated (VSLI) circuitry.

To other engineers electrostatics is but a theoretical model which when developed led to mathematical analyses applicable to idealized static cases. These models were superseded late in the last century with the elegant analysis of Maxwell which encompassed both statics and dynamics. As the practical implications of this theory developed, electrostatics faded in to the background as the expansion of the applications of electrodynamics came to fruition.

However, in recent years, applied electrostatics has emerged as an area of tremendous significance to industry. In any process involving the movement, placement, or alignment of small particles, the contact of dissimilar materials, or the coating of surfaces, electrostatic forces can play an important role. Thus industries as diverse as pollution control, sandpaper manufacture, photocopying, ore benefication, etc. can capitalize on the application of electrostatic forces selectively operating on small particles. Presently industries accounting for billions of dollars in business throughout the world exploit these particle forces. This clearly shows why the early science of electrostatics has evolved from an interesting curiosity to a strong and vibrant constituent of the Industry Applications Society of the Institute of Electrical and Electronic Engineers (IEEE).

SCOPE OF THE ELECTROSTATIC PROCESSES COMMITTEE

The Electrostatic Processes Committee was initiated primarily to provide a forum to discuss developments in the field of electrostatic precipitation. Since then it has broadened its scope to deal with all aspects of industrial applications of electrostatic phenomena. It is not easy to clearly define this range of activities since none of the applications are truly "static." Purists might become overly concerned with definitions establishing boundaries to the discipline. However, with some poetic license, one can visualize electrostatics as encompassing any electrical based process in which the primary action is governed by electrostatic forces rather than magnetic forces. Further extension of this concept implies that one is dealing with high voltage, low current applications or more generally situations where the ratio of voltage to current is very high (i.e., where the impedance is large). A second characteristic of this discipline is that the properties affected often involve phenomena other than electrical. Thus the disciplines of mechanical, chemical, and materials engineering must be considered in many of the practical applications. Table I shows the general range of processes and industrial applications that encompass the modern domain of applied electrostatics.

HISTORY OF THE COMMITTEE

The Electrosatic Processes Committee was originally formed as a result of the widespread interest and activity in the application of electrostatic precipitation to air pollution control primarily in the power industry. During the 1930's and 1940's major improvements were being made in the collection efficiency, reliability, and range of applications of precipitators and a need existed to exchange technical ideas and information. The first meeting of the committee was organized by Professor Gaylord Penney of Carnegie-Tech (inventor of the Westinghouse "Precipitron"). Following two years of effort he arranged for the committee to be structured under the AIEE Committee on Electronics. It was formally known as the "Subcommittee on Electrostatic Processes." The first meeting was held in January 1949 as part of the AIEE mid-winter meeting in New York. Two sessions were held both of which were chaired by Professor Penney. The main topic of discussion was electrostatic precipitation. However a few papers dealing with electrostatic separation and electrostatic painting were also presented.

The committee grew during the 1950's. In 1952, Dr. Harry J. White of Research-Cottrell took over as chairman and served in this capacity until 1957. During this time he also contributed papers supplementing the work which established his international reputation in the field of electrostatic precipitation.

During this period the meetings were held every year in January at the AIEE Winter General Meetings and, on occasion, sessions were also held in conjunction with the AIEE

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TABLE I
SOME SELECTED EXAMPLES OF ELECTROSTATIC PROCESSES AND THEIR INDUSTRIAL APPLICATIONS

Electrostatic Process	Industrial Application
One Stage Electrostatic Precipitation	Air pollution control (e.g.) flue gases, etc.
Two Stage Electrostatic Precipitation	Air cleaning (e.g.) clean rooms and heating system, etc.
Electrostatic painting	Surface coating and protection (e.g.) liquid spray painting, and powder coating
"Xerography" (Electrophotography)	Photocopying, medical imaging, etc.
Electrostatic Ink Drop Printing	High speed printing (e.g.) computer output
Electrostatic Spraying	Agricultural spraying (e.g.) pesticide application
Electrostatic Flocking	Surface coating (e.g.) sandpaper manufacture, fiber flocking, etc.
Electrostatic Separation	Particle segregation (e.g.) ore beneficiation, coal cleaning, etc.
Electrets	High impedance transducers (e.g.) electronic telephone and tape recorders, etc.
High-Voltage Generation	High energy physics (e.g.) Van de Graaff generators, etc.
Electrostatic Shielding	Prevention of electostatic discharge damage (e.g.) photographic films, integrated circuits, etc.
Static Discharging	Charge elimination (e.g.) airplane discharges, etc.
Electrogasdynamic Power Generation	Direct energy conversion (e.g.) possible for fusion process
Electrostatic Levitation	Containerless suspension of particles (e.g.) fuel pellet handling for fusion
Electrostatic Conveying	"Electric Curtain" (traveling electric waves) (e.g.) movement of small particles
Ion Generation	Corona treatment of plastic surfaces (e.g.) printing, etc.

Summer General Meetings. These were held regionally throughout the United States and sometimes in Canada. Attendance at the meetings varied but 50–75 people per session would be representative. A typical session is recorded for the January 1954 meeting. The technical session was held from 9:30 to 12:00 noon in the Grand Ballroom of the McAlpin Hotel in New York. Five papers were presented including one by Dr. White on electrostatic precipitation and one by Dr. O. C. Ralston, Chief Metallurgist of the U.S. Bureau of Mines, on the electrostatic separation of ores. The meeting of the subcommittee itself took place the same afternoon.

During the 1950's the majority of the papers dealt with electrostatic precipitation. Developments during this period led to better understanding of the physics and engineering design involved in the electrical energization, the flue gas and particle properties, and the aerodynamics of precipitators. Operating precipitators with collection efficiencies in excess of 99 percent now became feasible. This period also saw the first of the papers describing the Xerox process which had recently been commercialized by Haloid Corporation. During several sessions demonstrations of practical electrostatic paint spraying equipment were also held. In 1958 George W. Hewitt of the Westinghouse Laboratories took over a Chairman.

Following the 1963 amalgamation of the AIEE and the Industrial Radio Engineers (IRE) into the IEEE the Electrostatic Processes Committee found itself without a clearly defined "home." Initially it held its sessions as part of the IEEE Power Group and meetings were held every March during the Annual Convention in New York. Records during the early 1960's are incomplete, but E. Lee Coe Jr. of Joy Manufacturing Company served as Chairman from 1964 until 1966. During this period applications of electrostatics expanded and the topics considered became much more diversified and electrostatic precipitation became less dominant in the sessions. This eventually led to an objection being raised by the Power Group that many of the papers were unrelated to power technology and hence unsuited to their meetings. As a result the committee petitioned to the recently formed Industry and General Applications Group (now the Industry Applications Society) and was accepted into their structure of technical committees. Although the topics of the sessions had little direct relation to the rest of the convention, the common factor was an emphasis on industrial applications.

In 1967 Samuel A. Hawk of Battelle Memorial Institute began a four-year term as Chairman. He organized the first sessions that were held as part of the IGA Annual Meeting in Chicago in 1968 (this being only the Third Annual Meeting of the IGA).

In the early years of its association with the IGA Group interest in the Electrostatic Processes Committee suddenly declined. This was due not only to the change of venue but also to changes in the technology of electrostatics as the discipline expanded to cover a much broader field of interest. Thus although many people had common interests in electrostatic processes there was no established forum in which to share these interests. Perhaps the lowest point was reached during the 1971 meeting in Cleveland. Here the committee sponsored one session containing six papers and had a peak audience of 15 people which included the 6 speakers and the chairman! However, following this embarrassment the committee was reorganized and a period of rapid growth commenced. Within four years the Electrostatic Processes Committee was sponsoring 6 sessions with 38 papers and attendance in excess of 200 people. By 1974 the Committee had reached maturity and consistently became one of the dominant components of the IAS Annual Meetings accouting for up to 25 percent of the total papers presented with a related proportion of the total conference attendance (Table II).

This expansion and maturation of electrostatic processes obviously did not just happen. It was the result of a combination of factors not the least of which was the active promotion of the subject by a dedicated group of individuals who made it known that the electrostatic processes sessions filled a real need by encouraging technical communication in this field. It is difficult to single out individuals, but there is no doubt that the hard work and enthusiasm of Chuck Gallo of the Xerox Laboratories played a major part in the success of the revamped committee. The 1970's saw the continued

TABLE II
LEVEL OF PARTICIPATION OF ELECTROSTATIC PROCESS IN TECHNICAL SESSIONS OF THE IAS ANNUAL METTING 1971–1983

Year	Location	Total Technical Papers (All Committees)	Electrostatic Process Committee Sponsored		
			Number of Sessions	Number of Papers	Percentage of Papers for Total Meeting
1971	Cleveland	146	1	6	4
1972	Philadelphia	136	1	6	4
1973	Milwaukee	122	2	10	8
1974	Pittsburgh	158	6	38	24
1975	Atlanta	180	7	33	18
1976	Chicago	180	8	41	23
1977	Los Angeles	183	5	33	18
1978	Toronto	221	8	46	21
1979	Cleaveland	208	7	45	22
1980	Cincinnati	207	6	43	21
1981	Philadelphia	200	6	38	19
1982	San Francisco	218	8	54	25
1983	Mexico City	195	7	46	24

broadening of the subject matter and also an expansion into the international community. The active and regular participation by Professor S. Masuda and his colleagues from the University of Tokyo, the late Professor A. W. Bright and his colleagues from Southampton University in England, and Professor I. I. Inclulet and his colleagues from the Universtiy of Western Ontario in Canada showed that the subject was of international interest. In addition electrostatics became recognized as an academic discipline with important industrial significance. Another major development during the 1970's was the appearance of new papers on electrophotography. As original patents expired and competition began in the electrophotography industry many papers of fundamental significance were presented. Thus a typical annual meeting would have a distribution of papers consisting of two sessions on electrostatic precipitation, two sessions on electrophotography, two sessions on applied electrostatics, and one session on electrical coronas.

Table II clearly shows that the level of activity is not a transient phenomenon. The last ten meetings have been essentially "steady state" with participation rates ranging from 18 to 25 percent in each meeting.

The technical highlights and contributions of the Electrostatic Processes Committee are many and it would be difficult to identify all of the major individual technical contributions. (This is easier to do on an organizational level. For example, see the listing of past chairmen in Table III.) However, looking back over the 35 years of its existence one can highlight two major items. The first is the valuable and continuous contributions of Professor Gaylord Penney. He not only nursed the Committee into existence but has regularly contributed to the organization and has provided numerous technical papers since the first meeting. Although he is many years beyond normal "retirement" age he has maintained a vital and active research interest and his most recent paper, presented in 1982 in San Francisco, was as stimulating and important as his many other papers.

TABLE III
LIST OF CHAIRMAN, ELECTROSTATICS PROCESSES COMMITTEE

Term	*Name*	*Affiliation*
1947–1952	G. W. Penney	Carnegie–Mellon
1952–1957	H. J. White	Research Cottrell
1958	G. W. Hewitt	Westinghouse
1964–1967	E. L. Coe Jr.	Joy Manufacturing
1967–1971	S. A. Hawk	Battelle Memorial Institute
1971–1973	K. W. MacKenzie	Mahon Industries
1973–1975	G. S. P. Castle	The University of Western Ontario
1975–1977	C. D. Hendricks	University of Illinois
1977–1979	C. F. Gallo	Xerox
1979–1981	G. Fritz	Eastman Kodak
1981–1983	J. K. Edwards	Eastman Kodak
1983–	W. D. Greason	The University of Western Ontario

The second highlight has to be the presentation in 1983 at the Mexico City meeting of the Society Outstanding Achievement Award to Professor I. I. Inculet. This recognition not only honored the personal contributions of Professor Inculet but also underlined the high level of technical achievement represented by his work in the field of applied electrostatics and of the significant role played by the Electrostatic Processes Committee in the development of this technology.

ACKNOWLEDGMENT

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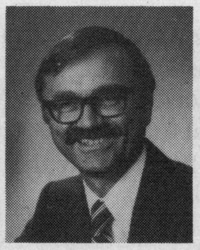

G. S. Peter Castle (S'66–M'68–SM'74) was born in Belfast, Northern Ireland, on May 30, 1939. He received the B.E.Sc. degree in electrical engineering from the University of Western Ontario, London, Ontario, Canada, in 1961, and the M.Sc.Eng. and D.I.C. degrees from the Imperial College of Science and Technology, London, England, in 1963, and the Ph.D. degree in 1969.

From 1963 to 1966, he was employed in the Research and Development Laboratories of the Northern Electric Company, Ottawa, Ontario, Canada, where he worked on the development of microwave stripline circuitry. In 1966, he returned to the University of Western Ontario as a Research Assistant in the Applied Electrostatics Laboratory. He has worked on a number of different projects in the field of applied electrostatics including electrostatic precipitation, corona discharges, ozone generation, and electrostatic application of pesticides. He is presently a Professor of Electrical Engineering at the University of Western Ontario.