The History of the Industrial Physical Chemistry Group – the early years

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Preface

The earliest roots of the Industrial Physical Chemistry Group go back to the 1960's. In this respect it is one of the earliest Subject Groups of the Faraday Division of the Royal Society of Chemistry. In its early years of existence, apart from having one of the most active conference programmes, the Group had a Committee which had a considerable influence on the development of UK research in physical chemistry. This influence stemmed from the composition of the Committee, which was composed of senior figures from both the chemical industry and chemistry departments of universities – an unusual feature at this time. From a historical perspective, it was considered appropriate to provide a record of this early period, as has been attempted here. It is a privilege to have been requested by the present IPCG committee to undertake this task.

In producing this record, it was some advantage to have had direct recollection of the period covered and the ethos which existed at that time. Indeed my first experiences date back to 1977, when I was co-opted on behalf of Dr. L.E.J. Roberts – one of the first members of the Group Committee, who was then Director of AERE, Harwell, to help organize the meeting on Concentrated Dispersions. Subsequently I was then fortunate to have been able to play an active role on the committee for many years until 1990 – up to the period covered by this record, and also serve as the representative of the IPCG with the SCI. In this latter period, the committee was chaired skilfully by Dr P G Farr. Peter has always been a loyal member of the Group and continued as Chairman in the following decade – keeping the Group on an even keel, in what were more turbulent times. It was Peter who first asked me to produce this record and I should like to acknowledge my gratitude and appreciation for all his encouragement. It is hoped that this record will be of interest to both the membership of the IPCG and also more widely within the RSC.

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1. The Industrial Physical Chemistry Group – history and origins

The Industrial Physical Chemistry Group (IPCG) is a subject group of the Faraday Division of the Royal Society of Chemistry. Its origins go back over 40 years and it is rather exceptional amongst other subject groups because it has a broad remit and was not formed to cover a specialized research field in physical chemistry. Furthermore the driving force for its foundation came from the inspiration of a group of research directors of several of the largest UK chemical companies, and in particular Dr. B. A. Pethica, who was at the time director of the Unilever Research Laboratory at Port Sunlight in Cheshire, and a member of the Council of the Faraday Society.

In 1969 a Sub-Committee was appointed by the Council to explore how closer links between academic and industrial research could be promoted by the Faraday Society. This committee met twice at Unilever House and the minutes of the meetings were considered at the Faraday Council meeting of 4th November 1969. The Council agreed that an Industrial Committee (the forerunner of the IPCG) be appointed on a permanent basis. Its terms of reference and outline constitution were recorded in the Council Minutes of 4th November 1969, an extract of which is shown below.

In summary it was agreed that:

1. The Industrial Committee shall make recommendations to the Steering Committee for Conferences and Discussions on themes of industrial interest judged to be timely and of high scientific merit in fields of interest to the Society. (These recommendations may be adopted from time to time as themes for ordinary meetings of the Society, or as themes for "special" or "occasional" meetings in addition to the Society's normal programme.)

2. The Industrial Committee shall be composed of 11 members of the Faraday Society, with powers to co-opt, as follows:
A Chairman, to be appointed by Council
The Chairman of the Standing Committee
Six other members drawn from a wide spectrum of British Industry to be nominated by the Standing Committee and approved by Council.
The President, Treasurer and Secretary, ex officio.

3. The first Chairman of the Industrial Committee was to be Dr. B. A. Pethica and Prof. T. M. Sugden, FRS (Shell) and Dr. P. J. Thomas (I.C.I) were appointed members; the 4 remaining members to be nominated at the March 1970 meeting of the Standing Committee.

The other Committee members duly appointed were Mr. D.A. Dowden (section manager Catalytic Chemistry, ICI), Dr. J.N. Haresnape (Manager, B.P. Research Centre, Sunbury-on-Thames), Dr. G.L. Kington, (Director of Research, The British Aluminium Co. Ltd) and Dr. E.R.S. Winter, J.E. Sturge Ltd.). The ex officio members of the Industrial Committee at this time were Professor G. Gee, FRS (President of the Faraday Society), Professor J. S Rowlinson, FRS (Treasurer of the Faraday Society) and Professor F. C. Tompkins, FRS (Secretary of the Faraday Society).

During this period the Council of the Faraday Society had been conducting negotiations with the Chemical Society and the Royal Institute of Chemistry with regard to the amalgamation to form the new Chemical Society. Following a referendum of the membership of Faraday Society in 1970 incorporation went ahead and was formally instituted on 1st January 1972. Under this agreement the Faraday Society ceased to exist independently as a Limited Liability Company and was liquidated and its assets transferred to the new Chemical Society. The new Chemical Society was comprised of the following Divisions: Faraday, Organic, Inorganic, Educational, Industrial and Analytical. The Faraday Division, the original Faraday Society, became the new division of physical chemistry of the new Chemical Society. The Industrial Committee still continued in the Faraday Division, despite there being an Industrial Division; it also retained its financial independence and continued to be auto-financing.

Until the mid 1970's the sub committee met regularly under the chairmanship of Dr Pethica, usually in the Charing Cross Hotel, and organized a series of successful meetings, some of which were the basis of Faraday Discussions and Symposia (*see details in appendix to follow)*. It was at one of these meetings on 10 March 1976 that Dr Pethica announced his resignation from Unilever and departure for Clarkson College, New York. This was totally unexpected by the committee, as will be recollected by Peter Farr who was serving as a co-opted member at this time. With the departure of Dr Pethica it was necessary to consider the future of the Sub-Committee, the election of a new Chairman, the choice of new members, their affiliation and the formalisation of the Sub-Committee. Historically, the Sub-Committee was Dr Pethica's brain child. Its membership was a group of like minded industrial physical chemists with representation from Shell, ICI, Unilever, BP and Harwell though no formal records of membership were drawn up. It had never any formal status within the Faraday Division although its minutes were reported to the Faraday

Council via Dr Pethica. Consequently it differed from other sub-units of the Faraday Division since it did not serve a membership.

These issues were considered at a Sub-Committee held at the BP Research Centre, Sunbury-on-Thames, on 26th April, 1977. Professor Everett, FRS, proposed that he would suggest to Council that the Industrial Sub-Committee should become a Sub-Committee of the Standing Sub-Committee on Conferences of the Faraday Division. Its aims would be to identify areas of physical chemistry of industrial interest suitable for formal or informal discussion. It would thus have an official recognition within a closely defined remit. This proposal was endorsed and it was considered that the Sub-Committee would provide another viewpoint other than from the academic community. A new chairman, Professor F. Franks who was also a member of the Faraday Council, was nominated, together with a new secretary, Dr T Edmonds. It was also agreed that the core membership of the Sub-Committee should be extended. This traditionally included permanent representatives from Unilever, Shell, ICI, BP and Harwell, the President and Treasurer of the Faraday Division and the Chairman of the Standing Sub-Committee on Conferences. Additional members had been co-opted to organise conferences in their specific area of expertise. Additional representation from NPL, the National Coal Board, the Central Electricity Generating Board, the British Gas Corporation and perhaps Rio Tinto Zinc would be considered.

Unfortunately this reconstitution of the sub committee could however not proceed on the basis of an informal request to the Faraday Council. The then President of the Division, Professor F C Tompkins FRS, insisted that there was a requirement for a formal application to be registered as a subject group, together with 25 signatures of support from Division members.

Consequently in November 1979 the secretary, Professor T Edmonds of the BP Research Centre, addressed a formal letter (see enclosed) to senior members of the Faraday Division including the Officers and Council requesting their support in the formation of an Industrial Physical Chemistry Group set up according to the Terms of Reference and Rules described in the attached letter. There were 47 signatories of enthusiastic support including those from Professor J S Rowlinson (the then Division President), Professor Sir George Porter, Profs Tompkins, Buckingham, Gray, Sheppard, Albery, Buckingham and Everett. These signatures requesting the formation of the Industrial Physical Chemistry Group (IPCG) were submitted to the Honorary Secretary of the Division, and the Faraday Council gave its approval on 29th February 1980. The Treasurer

was now able to set-up a Trust Fund account for the Group. This enabled the Group, which had been self-financing, to avoid VAT on its turnover related to the informal meetings it organised on average twice per annum.

The Terms of Reference were now formally established (details to follow)

At the next IPCG Committee on 30th April, 1980 it was proposed that the Annual Subscription for IPCG membership should be £ 1.00. This was formally approved by Council on 29th May 1980 and it was agreed that the subscriptions should be transferred in total to the Group to defray administration and other costs. Arrangements were made for details of the new Group to appear in the 1981 subscription renewal form. To promote the Group, announcements were also placed in Chemistry in Britain and Faraday Transactions. These read as follows:

A new Subject Group has recently been approved by Faraday Council. The Industrial Physical Chemistry Group (formerly the Industrial Sub-Committee) Faraday Division aims to identify areas of physical chemistry of importance to industry and where significant developments are taking place, and to organise informal meetings, Discussions or Symposia to discuss relevant topics in these areas. For further details contact Prof. F Franks, Department of Biology, University of Cambridge, Chairman or Prof. T Edmonds, BP Research Centre, Sunbury-on-Thames, Secretary.

The response to join the new Group was very encouraging, with a membership number of 101 on 29th March 1981. At that time there were 11 specialised Subject Groups in the Faraday Division. Despite the rather broad remit of the IPCG, its membership at its outset was already middle ranking in number, and exceeded several other long established Subject Groups.

2. The Industrial Physical Group – conferences and scientific activities in the first two decades

From its foundation the Group committee was very active in identifying areas of physical chemistry, which were of major importance in a range of industries, and where a greater fundamental understanding was required. Some of these areas, which may hitherto have been considered too applied and multidisciplinary to be appropriate for a research

conference by the Faraday Division, formed the basis of topics for numerous scientific conferences over the following 20 years. Indeed, many topics were promoted into highly successful Faraday Discussions and Symposia. The wide experience and senior position of the committee members were both important in co-opting outstanding researchers in various fields, to act as organizers and speakers. A feature of many of these conferences was the involvement of other Groups of the Faraday Division and also other scientific societies who sometimes acted as joint organizers. Some of the IPCG conferences and topics covered over the period are given in the appendix below.

Although it is not possible to give details of these conferences here, it may be appropriate to highlight one area - that of **colloid science**, which was identified to be of particular importance by the IPCG committee in the earliest years after its formation in 1969. Committee members, - in particular Brian Pethica, were indeed inspirational in proposing the topics for most of the early Faraday Discussions and other conferences concerned with colloid science which were held in the 1970's. The impact of these conferences, and the advisory role of the Committee members in the future policy of the Science Research Council (SRC), subsequently influenced the future direction of UK research in this field for many years to come. To illustrate the impact of the Group it is necessary to describe the background in this period in more detail:

In the decade before 1970, colloid science had become a neglected area for academic research in UK universities. It was perhaps perceived as multidisciplinary and ill-defined for research in basic physical chemistry compared to ongoing activities involving surface chemistry and catalysis, where model systems were available such as thin metal films under vacuum conditions – (the publications in Faraday Transactions and Discussions in the period perhaps reflect this emphasis). At this time, UK research in the general area of colloidal dispersions (now known as **nanoparticle systems**) was being conducted on a limited scale at only a small number of centres in universities and industry. This was despite the recognized importance of this area to a large and increasing range of problems in industry, agriculture, food and biomedical sciences. Furthermore, although the importance of colloid science was well appreciated in the larger industries (Unilever, ICI, BP, Shell, UKAEA, etc), many smaller concerns were unaware of the role played by colloidal phenomena in their activities. This situation was of acute concern to Brian Pethica, the first Chairman of the Group, who was then research director at Unilever, Port Sunlight. Here the Basic Division carried out extensive research on colloidal systems and collaborated with

universities, in particular Bristol where the Leverhulme Trust supported the Chair in physical chemistry.

As a result of this lack of funding and research in universities and the pressure from research directors in large companies whose activities involved colloid science, the Chemistry Committee of the SRC, set-up a **Colloid Science Panel in 1971**. The terms of reference were:
" to review the present status of the science of colloidal dispersions, both in academic institutions and in industry; to document the case for special support of this subject and to recommend methods of achieving its development "
The committee of the Panel had seven members including two from industry (Brian Pethica, Unilever and G.D. Parfitt, Tioxide International Ltd.) and two from the Chemistry Department at Bristol University (R.H. Ottewill and D.H. Everett) – Douglas Everett was on the Committee of IPCG and head of Department at Bristol. The Chairman of the Panel was Professor G. Allen of the Department of Chemistry at Manchester University. (Professor Allen was later to become science director of Unilever and subsequently Chairman of the SRC).

The Panel produced its first report in January,1972 (*Science Board of SRC, COLLOID SCIENCE, Report of a multidisciplinary panel on the science of colloidal dispersions*). The recommendations of the Panel were all endorsed by SRC and the topic was designated an *area for special encouragement*. The report was widely circulated both within the United Kingdom and overseas. In addition it formed the basis of SRC policy in this field, and had a significant influence on the development of colloid science in the UK and elsewhere. The report resulted in a substantial boost in research funding in universities and support for advanced education (Bristol Colloid Science School) and grants of numerous CASE awards to foster Industrial/University partnerships. The Panel also made recommendations for areas of special study, either for intrinsic scientific merit alone, or because in addition they were foreseen as having an immediate or long – term influence on industrial processes or products. These areas included: theoretical studies; interparticle forces; colloid stability; colloid properties. For the latter the development of new optical and spectroscopic techniques, rheological properties of model systems were recommended for special attention. In the following decade members of the IPCG, often in collaboration with those from the Colloid and Interface Science Group (CISG) of the Faraday Division and the Colloid and Surface Chemistry Group of the Society of Chemical Industry (SCI), sought to stimulate research on these topics by organizing joint scientific conferences. Of note amongst several other

meetings (see appended list), were four highly successful Faraday Discussions: No. 57. Gels and Gelling Processes (1974), No. 61. Precipitation (1976), No. 65. Colloid Stability (1978) and No. 76. Concentrated Colloidal Dispersions (1983).

The Colloid Science Panel was dissolved in June 1972 after reporting. It was reconvened in the autumn of 1974 with a new membership and with a remit to review progress made since 1972 and to report to the Chemistry Committee of SRC. The new Panel of twelve now included five members of the IPCG, of whom two were from the Committee: Professor Everett (as chairman), Brian Pethica (Unilever), J. D. Birchall (ICI Mond Division), A.E. Comyns (Laporte Industries), A.L. Smith (Unilever). The new panel reported in August 1978 (Report of the Colloid Science Panel, SRC, London). It was concluded by the SRC that the Panel had successfully stimulated research over almost the whole range of problems recommended for special study in its first report on "Colloid Science". In view of its potential importance, the increase in strength of colloid science in Britain had represented an important long-term scientific investment. Important developments in the application of new experimental techniques to colloid science had been made and it was hoped that further support would enable workers in the UK to maintain their position in the forefront of this area of science. (For example - particular advances had been made in the application of neutron scattering techniques, using the facilities at UKAEA, Harwell and later at the Institut Laue Langevin in Grenoble). It was noted that the Panel had endeavoured to promote the growth of research in an undeveloped area during a period when university funds were in decline and that the success achieved was particularly encouraging for the future health of the subject. The SRC concluded that colloid science had become an established research area within chemistry and it was therefore agreed that the need for priority financial support and a special Panel had diminished. Consequently there was no longer a requirement for the Panel and it was considered that in the future the special status for funding by SRC was no longer necessary.

Another outcome of the SRC report on Colloid Science in 1972, was the formation of a new subject group of the Faraday Society known as the Colloid and Interface Science Group (CISG) – an initiative strongly promoted by Professor Ottewill, at Bristol where much of the future research on colloids would be focussed. When this new group had become established there was consequently much less emphasis from the ICPG in promoting conferences on colloid science particularly after the departure of Brian Pethica. This avoided any overlap of interests,

although the policy of holding joint meetings between ICPG and CISG has continued to the present day. It is however of interest to note that the CISG has become one of the most active of any subject Group in the RSC Faraday Division, with one of the largest memberships. Furthermore, in 2002, the CISG and the SCI, Colloid and Surface Chemistry Group, formed the " Joint Colloids Group", providing a coherent focus for the UK colloid and and interface science community. These later developments are perhaps some testament to the inspiration of Brian Pethica and other members of the original Industrial Committee of the Faraday Society who had earlier promoted colloid science.

3. The Industrial Physical Group – its evolution and role in the RSC of today

It may be of interest to consider in more depth the historical background of the old Faraday Society and of UK chemistry research in the late 1960's when Dr. Pethica and his colleagues - who all occupied senior posts in industry, made their attempt to set-up the forerunner of the IPCG.

The Faraday Society had been founded in 1903, in honour of Michael Faraday, an outstanding British scientist who had made enormous contributions in the nineteenth century to fundamental understanding in electrochemistry and other fields, as well being at the forefront in applied research and innovation. Such a tradition had been reflected by those elected to be the early Presidents of the Society. These were eminent men in their fields who had been creative both in fundamental research and industrial innovation: These included Sir Joseph Swann (1903-1904), Lord Kelvin (1905-1907), Sir William Perkin (1907), Sir Oliver Lodge (1908-1909), Sir James Swinburne (1909-1911) –an electrical engineer and manufacturer, discoverer of Bakelite, who revolutionized the plastics industry, (Sir Richard Glazebrook (1911-1913) first director (until 1919) of the National Physical Laboratory, which was formed in 1899 in Teddington.

This tradition of the Society, in promoting links between basic research and industrial innovation was continued during WWI (Sir Robert Hadfield, FRS, metallurgist –discoverer of manganese steel and owner of Hadfields Steel Foundary in Sheffield) and up until WWII (Sir Robert

Robinson (1922-1924) organic chemist and Nobel prize winner-development of plant dyestuffs) ; Sir Robert Mond (1930-1932) industrialist and Director of Brunner Mond & Co., the forerunner of ICI.

In the aftermath of WWII, great changes occurred in the organization and funding of scientific research and development in the UK. There was a marked increase in research funding by Government, with the setting up of organizations such as the United Kingdom Atomic Authority (UKAEA), and the Research Associations and by University expansion supported by the Department of Scientific and Industrial Research (DSIR). These changes were particularly evident in the chemical and physical sciences where effort on fundamental research expanded. Chemical research and development also increased in the large industrial companies, such as ICI, Unilever, BP, and Shell where corporate laboratories were formed, dedicated to more fundamental research.

With these changes there followed an increasing output of research publications in chemistry. In physical chemistry those of the Faraday Society (Transactions, published from 1905 to 1971; and Discussions, 1947 to 1971) were of an exceptional standard and carried high academic prestige.

By the 1960's a clear distinction had developed between "applied" and "fundamental or basic" research and this was reflected in the Journals of publication. Publications of the Faraday Society now were evidently in the latter category. Authors were predominantly from the Universities in the UK although a significant contribution of papers came from physical chemists working in the Corporate research laboratories of a few large UK industrial companies and the Chemistry Division of AERE, Harwell (the research establishment of the UKAEA in Berkshire).

An increasing divide had developed between what was termed "pure" and "applied" research. Some in industry were concerned that the physical chemistry research carried out by the Universities, although of very high standard, was becoming more detached from the perceived interests and needs of the chemical industry. These perceptions were perhaps reflected in the membership of Council of the Faraday Society which was now drawn predominantly from the most highly accomplished academics in the Universities, who unlike previously, had never been involved with industry.

The late 1960's and early 1970's were indeed a golden period for fundamental research in chemistry, with the expansion of Universities

and increased funding from Government, particularly the Science Research Council (SRC). It was perhaps in this atmosphere, that Brian Pethica had shown deep foresight in his proposal to set-up the ***Industrial Committee*** within the Faraday Society. It is not known if he anticipated the more difficult times ahead in the following decades, both for chemistry in the Universities and also the UK chemical industry. However it is more than ever clear today that the IPCG, which evolved from this early Industrial Committee, still has an important role to play in the RSC, because of its continued links to industry and its broader multidisciplinary base.

Appendix 1

Meetings organized by the Industrial Physical Chemistry Group and in collaboration with other scientific societies in the period 1970 – 1990 .

Thin Liquid Films, Faraday Special Discussion, Cambridge University, September, 1970.

Computer Simulation of Complex Reaction Systems, One day informal meeting, Shell, Thornton, September, 1971.

Ordered Structure of Liquids, One day meeting, BP, Sunbury, April, 1972.

Solid/Solid Interfaces, Faraday Special Discussion, Nottingham University, September, 1972.

Chemical and Electrical Effects from Mechanical Action of Polymers, Informal Symposium, Royal Institution, London, December, 1972.

Fogs and Smokes, Faraday Symposium, University of Swansea, March, 1973.

Gels and Gelling Processes, Faraday General Discussion, No. 57, University of East Anglia, August, 1974.

Hydrogen in Metals, Informal meeting, University of Birmingham, January, 1976.

Aqueous Solution Properties of Synthetic Polymers, Informal meeting, Cranfield Institute, January, 1976.

Precipitation, Faraday General Discussion, No. 61, University of Manchester, April, 1976.

Concentrated Dispersions, Faraday/SCI Symposium, Brunel University, September, 1977.
(note : the above meeting was the precursor of the Faraday General Discussion, No. 76, Concentrated Colloidal Dispersions, Loughborough, September, 1983.)

Molecular Interaction, Microstructure and Rheological Behaviour, Informal Discussion, Cranfield Institute, January, 1978.

Colloid Stability, Faraday General Discussion, No. 65, Lunteren, Netherlands, April, 1978.

Transport across Synthetic Membranes, Informal meeting, Cranfield Institute, January, 1979.

The Physical Chemistry of Non Aqueous Foams, SCI/Faraday meeting, Strathclyde University, Glasgow, April, 1980.

The Physical Chemistry of Microemulsions, Informal meeting, Trinity Hall, Cambridge, September, 1980.

Chromatography, Equilibrium and Kinetics, Faraday Symposium, University of Sussex, December, 1980.

Pyrolysis, Cracking and Degradation, RSC Autumn Meeting – joint with Faraday Division, University of Leeds, September, 1981.

Supercritical Fluids, Informal meeting, Girton College, Cambridge, September, 1982.

Nucleation and Crystalisation, Informal meeting, Girton College, Cambridge, July, 1983.

Ion Adsorption and Exchange at Inorganic Surfaces, Informal meeting, Girton College, Cambridge, September, 1983.

Metal Polymer Interface, Informal meeting, Girton College, Cambridge, September, 1984.

Cell Adhesion to Solid Surfaces, Informal meeting, Girton College, Cambridge, September, 1984.

Laser Spectroscopy Techniques in Solid/Gas Reactions, Joint SCI meeting, SCI, London, May, 1985.

Water Activity, Informal meeting, Girton College, Cambridge, July, 1985.

Molecular Approach to Lubrication and Wear, Informal meeting, Girton College, Cambridge, September, 1985.

Physical Chemistry of Water Soluble Polymers, Informal meeting, Girton College, Cambridge, September 1986.

Interfacial Reactions in Semi-Conductor Device Processing, Joint Institute of Physics meeting, Girton College, Cambridge, July, 1987.

Physical Chemistry of Carbohydrate Solutions, Joint meeting, Regensburg, W. Germany, August, 1987.

Interactions of Biologically Active molecules with Membranes, Informal meeting, Girton College, Cambridge, September, 1987.

Applications of Neutron Scattering in Colloid and Surface Chemistry, Joint SCI meeting, SCI, London, September, 1988.

Materials for Non-linear and Electro-optics, Informal meeting, Girton College, Cambridge, July, 1989.

Drilling Fluids in the Oil Industry, Joint SCI meeting, Royal Holloway and Bedford College, London, September, 1990.