The 1981 Pittsburgh Conference: A Special Instrument Report

1981 was the year of the cathode-ray tube at the Pittsburgh Conference on Analytical Chemistry and Applied Spectroscopy. The CRT appeared on a wide variety of instruments at the 32nd edition of this venerable show as virtually every type of instrument became more highly automated—reflecting, says one manufacturer's representative, the need to make more efficient use of the $45,000 yearly investment represented by each laboratory technician. Everything else about the meeting was bigger this year also. Attendance grew 7.6 percent to 17,258, the number of exhibitors rose 9 percent to 498, the number of booths at which products were displayed rose 13.6 percent to 1200, and the number of technical papers went up 12 percent to 913. A better indication of the meeting's recent rapid growth are the corresponding figures from 1976—10,500 attendees, 324 exhibitors, and 497 technical papers. The meeting is definitely becoming one of the largest of its type, and that is becoming a problem for Atlantic City, its host for the second time and the scheduled host for 1982. Already, a portion of the famed boardwalk in front of Convention Hall has had to be cordoned off for storage of packing crates because the normal storage space within the hall itself was occupied by the meeting, and future meetings may require more drastic measures. There were some conflicting opinions about whether the increased attendance would be reflected in increased sales leads. One salesman noted the "conventional wisdom" that there are only about 5000 people walking around the meeting with money in their pocket, no matter how many come through the door. Academic scientists were quite obviously more conservative in their buying plans this year, presumably because of the Reagan Administration's planned slashes in National Science Foundation funding for instruments—especially the elimination of the proposed $75 million program for upgrading large instruments at the major universities. Industrial scientists, in contrast, were thought to be on a buying spree whose ultimate cause may be the recent rise in profits in the petroleum and petrochemical industries. A similar contrast could be observed in the employment center. Job openings in government and academia were virtually nonexistent, while industry filled several bulletin boards with vacant positions. These are clearly both the best of times and the worst of times.

Myriad Ways to Measure Small Particles

Most everyone has probably seen those toys that allow children to draw pictures or write messages on a plastic screen with the aid of a magnet that traces out the desired pattern. A would-be manufacturer of one such device, having worked out the details in a prototype, set about producing the sketching toy in volume. But, mysteriously, none of the mass-produced items worked properly. After numerous chemical tests failed to uncover the cause of the malfunction, one of the analytical labs suggested measuring the size of the small, iron particles that were the active agent in the writing medium. By some mischance, according to Richard Karuhn of Particle Data Labs, the Elmhurst, Illinois company that did the measurements, the particles in the production toy were some 5 micrometers smaller, on the average, than those in the prototype. Because of the smaller size, the electrostatic force holding the iron particles to the screen increased to the point that the force from the magnet that ordinarily caused them to move and thereby form patterns on the screen was ineffective.

Underwhelming, you say? Well, perhaps, but the application of physical and chemical principles in the form of instruments that can help solve such apparently mundane problems is what the Pittsburgh Conference is mainly about. However, it is only in the last decade that U.S. manufacturers have realized how important the properties of fine particles can be to a successful product. Applications of instruments for counting and sizing small particles range from controlling the sweetness of chocolate, to ensuring that rocket propellants burn at the right speed, to validating the number of viable sperm in cryogenically frozen semen in animal husbandry. Karuhn predicts that a rapidly growing interest in particle technology will lead to a big demand for people trained in this field. There may also be more sophisticated instrumentation in the not too distant future.

This is not to imply that such instrumentation now lacks the amenities of other kinds of equipment. Automated machines with microcomputers and data systems are available. And there are lasers. Lasers have yet to make much of a dent in the commercial spectrometer market, at least as gauged by the wares exhibited at the Pittsburgh Conference. But these modern-day light sources are already staple items in particle-measuring devices. The way to use lasers that might most stir the heart of a frontier researcher is in photon correlation spectroscopy. A relatively new method for determining the size and diffusion coefficient of particles dispersed in a liquid, photon correlation spectroscopy has not yet reached the status of a mainline technique. One limitation is that it gives only an average particle size rather than a distribution—that is, the number of particles in each size range.

Particles in a liquid are in constant, random motion (Brownian motion). Because of this, laser light scattered by the particles will fluctuate as the phases of scattering contributions from various particles change relative to one another. Moreover, the motion of the particles will be affected by their size, with smaller particles moving faster, and so on. A low-power helium-neon gas laser, which emits red light, is the source. A photomultiplier records the fluctuations in the scattered light. And a special-purpose computer calculates a mathematical entity called a correlation function. The diffusion coefficients and sizes of the parti-

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