Equipment

The information reported here is obtained from manufacturers and from other sources considered to be reliable. Science *does not assume responsibility for the accuracy of the information. A coupon for use in making inquiries concerning the items listed appears on page 1462.*

■ TEMPERATURE MONITORS for any temperature from −400° to +3000°F are complete controls ready to connect to thermocouples and to source of power. Each monitor contains a meter-type relay together with transformer and rectifier or other components for the type of control required. Control action may be on-off or limit with external reset. Accuracy on the order of ±2 percent applies to most temperatures. (Assembly Products Inc., Dept. 81)

■ PORTABLE POTENTIOMETER PYROMETER uses interchangeable scales to adapt to a variety of thermocouples. Scales are available for Pt, Rh-Pt; #242–#33 alloy; Ni-Ni 18 percent Mo; and LC type Y. The instrument also measures d-c potentials from 0 to 155 mv. (Technique Associates, Inc., Dept. 82)

■ PHASE-ANGLE METER provides direct reading without ambiguity over the frequency range 20 to 20,000 cy/sec. Angle is indicated from 0 to 360 deg with accuracy ±1 deg. Complex or sinusoidal waveforms are accepted as input; the output is suitable for operation of recorders. (Control Electronics Co., Inc., Dept. 83)

■ DUAL-BEAM OSCILLOSCOPE has vertical amplifiers with calibrated sensitivities in 16 steps from 200 μv to 20 v/cm. Frequency response is from direct current to 100 kcy/sec at maximum sensitivity. Input impedance is 1 megohm, 47 pf from 1 mv to 20 v/cm. Sweep rates are selectable from 1 μsec to 5 sec/cm. A horizontal-input amplifier provides for curve tracing with both beams simultaneously at sensitivities to 0.1 v/cm. (Tektronix, Inc., Dept. 85)

■ FREQUENCY STANDARD for 400-cy/sec operation is said to be position insensitive. Output is frequency stable within ±0.001 percent, under environmental conditions of vibration, from 50 to 2000 cy/sec, up to 18 *g*; shock up to 50 *g*; steady-state accelerations of 20 *g*; and temperature between −20° and +70°C. The unit is hermetically sealed. (Gyrex Corporation, Dept. 86)

■ RADIOACTIVITY STORAGE CONTAINER for medical applicators consists of a lead shield 2 in. thick mounted in a cubical wood enclosure. The container will safely shield up to 125 mc of cobalt-60 or 165 mg of radium. (NRD Instrument Co., Dept. 111)

■ ULTRASONIC GAGE is self-contained for thickness gaging, recording, and detection of laminar flaws and includes connections for automatic sorting and rejection. Thickness between 0.005 and 2.5 in. can be measured from one side of the material. Accuracies as high as ±0.02 percent are said to have been achieved in applications which involved observations of differential between a sample and a reference of the same nominal thickness. The output record is produced by a strip-chart recorder. Readings are made directly, in terms of thickness. (Branson Instruments Inc., Dept. 88)

■ ANALOG-TO-DIGITAL CONVERTER operates by comparing input voltage with an internal reference voltage derived by summing weighted current from a precision power supply. The instrument is a solid-state device operating at the rate of 100,000 bits per second to produce 6000 conversions per second. Accuracy is ±0.05 percent of full scale. A conversion can be initiated by a push button or by an externally applied 2-v transient. The reading is displayed visibly by neon indicators in binary-coded decimal form and is available at output terminals. Both serial and simultaneous outputs are available. (Fischer and Porter Co., Dept. 90)

■ POWER SUPPLY is designed to furnish low-voltage a-c and d-c power for student laboratory use. The unit, which plugs into a standard 115-v a-c outlet, may be used by as many as eight students at a time. Outputs include 6 and 12 v d-c at 10 amp and 6, 12, and 24 v a-c at 10 amp. Also provided are four neon continuity lamps for circuit-tracing. (Universal Scientific Co., Inc., Dept. 89)

■ SIX-CHANNEL RECORDER provides rectilinear inked or electric-stylus records. Input range for 20-mm deflection is adjustable from 1 to 200 v in seven steps. Drift is ±0.5 mm in 8 hr. Six paper speeds, from 0.5 to 25 or from 1.2 to 50 mm/sec, are regulated within ±1 percent. Response is flat to 40 cy/sec. Channel-gain calibration is provided by an internal standard cell. A regulated stylus power supply is available as optional equipment. (Mid-Century Instrument Corp., Dept. 109)

■ GLASS-SCREENS perforated with 562,000 precisely etched holes per square inch are being produced for electron storage-tube applications. Transmission of the screens may be from 40 to 70 percent. The screens are manufactured by a photo-etching process. The largest screen diameter is 1.5 in., and the thickness is 0.002 to 0.005 in. (Corning Glass Works, Dept. 112)

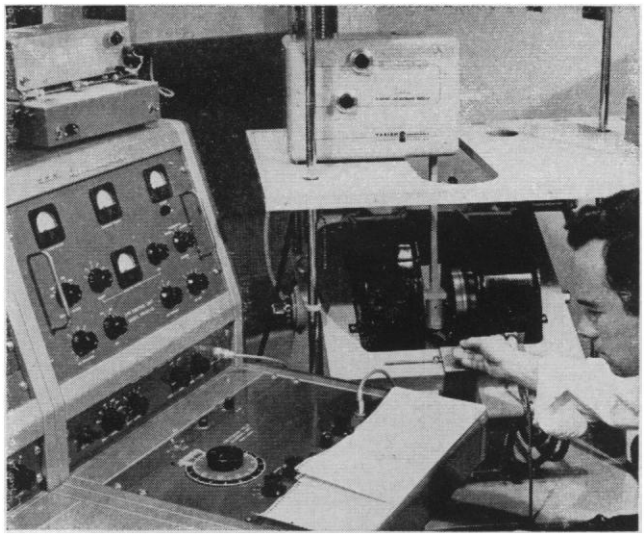
JOSHUA STERN
National Bureau of Standards

HOW TO "SEE" AND "FOLLOW" UNPAIRED ELECTRONS

through EPR spectroscopy, they pinpoint conditions on a molecular scale

(Electron Paramagnetic Resonance)

14
E-P-R
AT WORK



EPR spectroscopy provides the scientist with a singularly exclusive "sense." It searches the specimen and sees unpaired electrons and their environmental interactions. These may be observed in many forms: free radicals – biradicals – triplet electronic states – transition element ions – semi-conductor impurities – radiation damage sites or color centers.

Interpretation of the EPR spectrum through the location and intensity of resonant peaks can often reveal quantity and identity of the unpaired electrons as well as information about the surrounding molecular structure. To assist the study of chemical kinetics, EPR spectra can be made under varying temperature and chemical environment.

In addition to manufacturing EPR spectrometers and accessories, Varian Associates maintains a staff of scientists experienced at EPR techniques and able to advise on diverse applications.

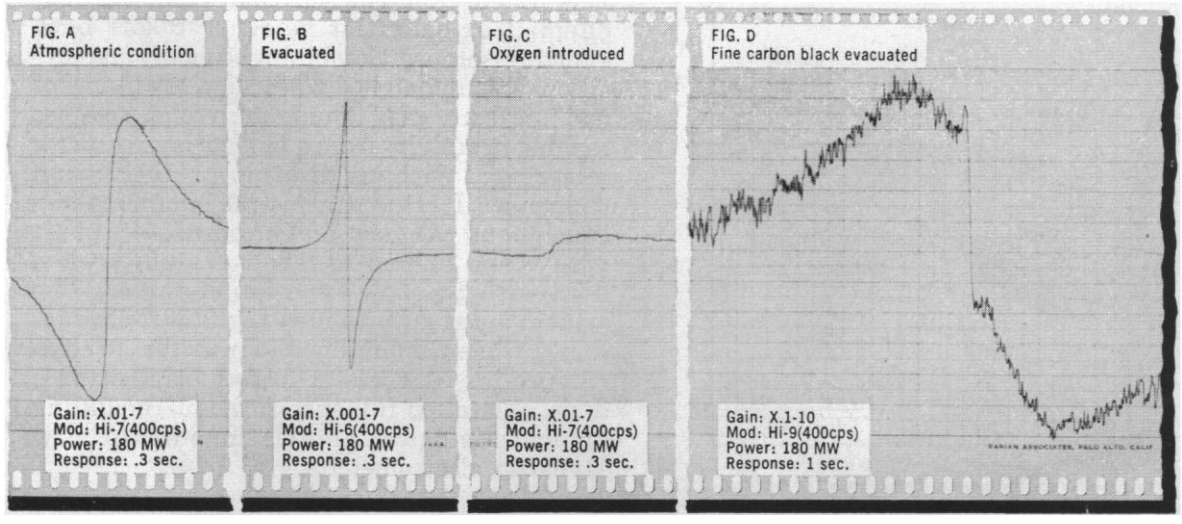
Number 14 of a series

DISAPPEARING FREE RADICALS

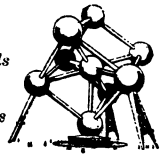
DISCUSSION: A considerable amount of interest has been generated in the study of paramagnetic resonances obtained in carbon blacks, stemming perhaps from the importance of carbon blacks as reinforcements in rubbers and their applications in catalysis.

Figure A shows a typical EPR spectrum of a carbon black with a slightly larger than average particle size that has been exposed to atmospheric conditions. When this sample is pumped on with a vacuum pump, the spectrum in Figure B is obtained. The gain in B is down by a factor of 10. The spectrum in B indicates a typical free radical at $g \cong 2$ but differs from Figure A in that the line width has changed from 40 to 7 gauss. When pure dry oxygen is introduced into this same tube the free radicals seem to disappear and the spectrum in Figure C (gain same as A) is obtained. If the oxygen is again pumped off and dry N_2 is introduced, the same sharp resonance of Figure B persists. If O_2 is introduced, on top of the N_2 again nothing happens to the resonance line, but if the N_2 is first pumped off and O_2 is added, then the spectrum of Figure C is repeated. If instead of O_2, ordinary air from a compressor is introduced, the spectrum of Figure A is obtained. Figure D is a spectrum of a more finely divided carbon black, to which the same pumping procedure was applied.

The disappearance of the free radicals seems to be dependent upon the amount of oxygen that can be adsorbed on the surface of the carbon black particles. The adsorption of oxygen results in a paramagnetic broadening of the free radical occurring in the black itself. The effect can be so great as to broaden the line to the extent that it disappears into the noise level.



Selected by the U.S. Government for the Brussels World Fair, Varian 60 mc NMR Spectrometer is available for limited studies while on exhibit.



Write today for additional examples and information on Varian's EPR and NMR Spectrometers and services

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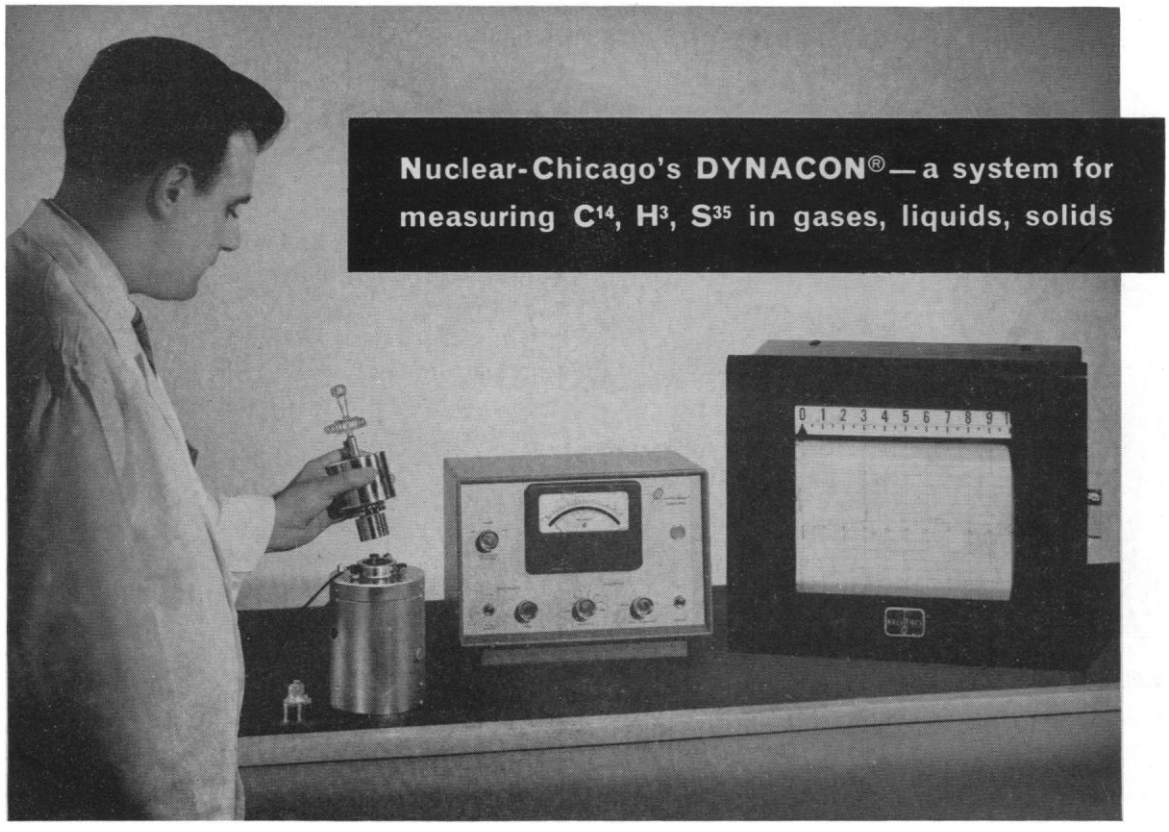
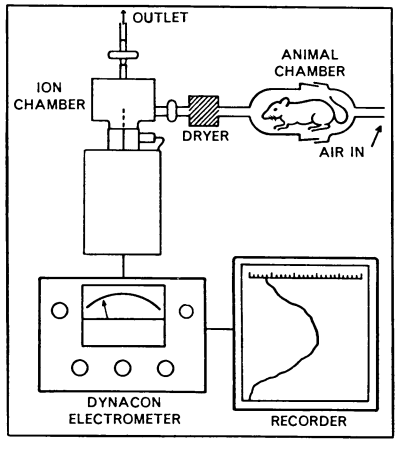
a new radioisotope counting system for biological and clinical research



Operator places 250 ml. ion chamber on Dynacon converter. Sample may be read directly in microcuries or dis./sec. on meter and recorder.



Apparatus for continuous measurement of respired $C^{14}O_2$ from small animals includes glassware, flow-type ion chamber, Dynacon electrometer, and chart recorder.

The Model 6000 Dynacon is an outstanding new system from Nuclear-Chicago for the biochemist or scientist measuring soft beta emitting isotopes. Combining economy and precision with unmatched versatility, it will accept and measure gas, liquid, and solid samples ranging in activity from a millicurie to a micro-microcurie without dilution or absorption techniques. It is the ideal instrument for making continuous gas flow measurements in plant uptake and animal metabolism studies when used with the flow-type ion chamber. The system's design provides highest reproducibility while eliminating all errors due to coincidence losses, register losses, or electronic drift. Write for full specifications including typical biological applications of the new Dynacon electrometer.

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