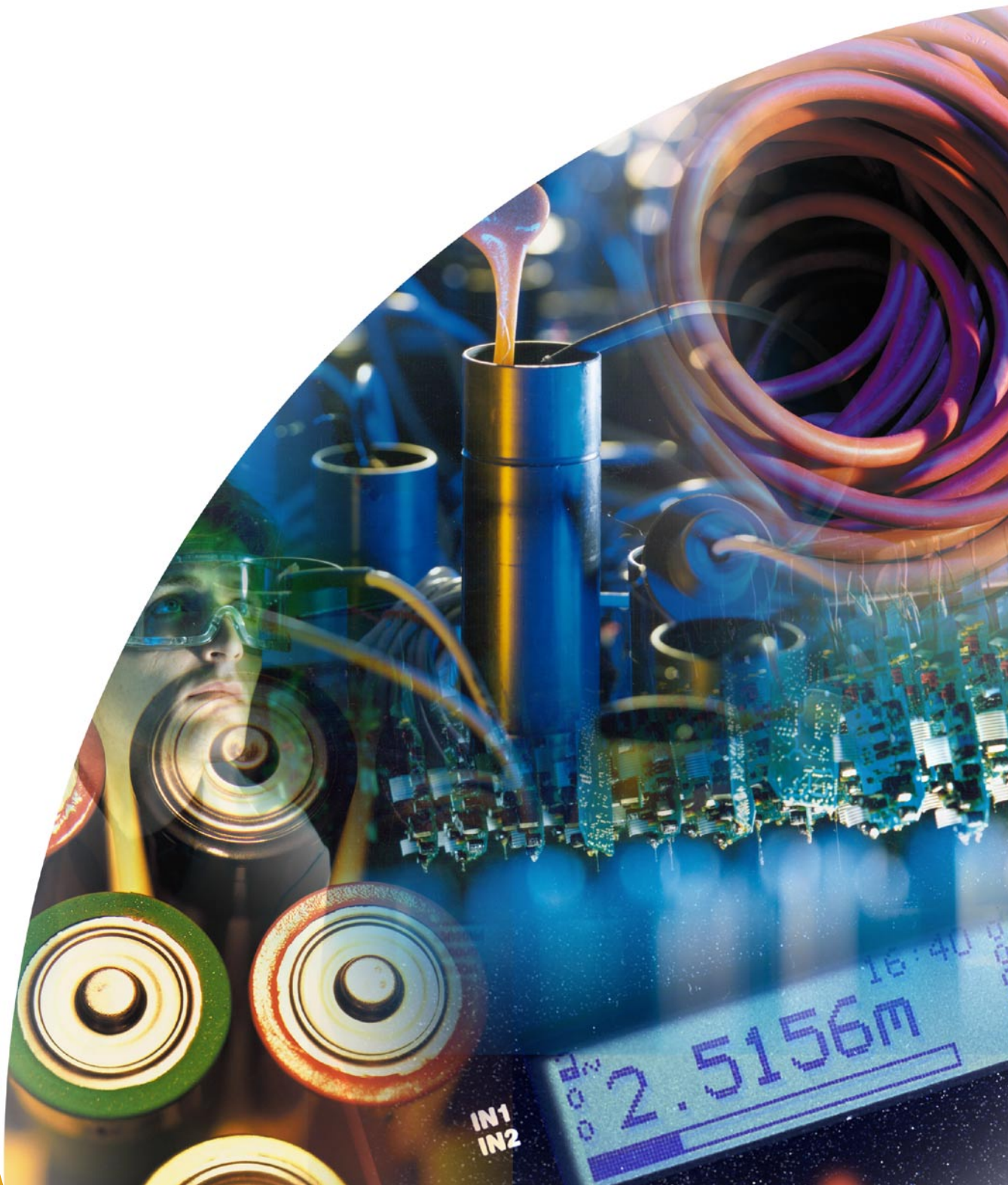


Materials



materials

Total system capability

Solartron has pioneered the development of instrumentation for electrical impedance spectroscopy (EIS), utilizing over 50 years of measurement expertise, resulting in a comprehensive range of market leading products with unsurpassed accuracy and reliability. Supporting software ensures a completely integrated measurement solution that combines total system control with ease of use.

Impedance measurement

Virtually every liquid and solid is able to pass current when a voltage is applied. If a variable (ac) voltage is applied to the material, the ratio of voltage to current (V/I) is known as the impedance.

In many materials, especially those which are not generally regarded as conductors of electricity, the impedance varies with the frequency of the applied voltage in a way that is related to the properties of the liquid or solid. This may be due to the physical structure of the material, to chemical processes within it, or to a combination of both.

The physical and chemical properties of some materials change dramatically with temperature and the combination of impedance and temperature testing is very important for the complete characterization of these materials.

Electrical techniques for materials characterization

Electrical tests on materials investigate their ability to store charge (capacitance) and transfer charge (conductance). Analyzing these parameters can provide valuable information in terms of a material's physical and chemical properties including: impedance, porosity, tan delta, molecular relaxation, grain boundaries, phase changes, permittivity and modulus, along with many other parameters.

Ceramics

EIS gives a clear indication of crystalline structure - such as grain boundary effects and electrical homogeneity - enabling fast evaluation of the effects of process variables, and optimization of manufacturing parameters in products such as fuel cells, gas sensors and insulators.

Polymers

For optimizing the dielectric properties of high voltage cables to improve insulation and reduce energy loss. Polymers are also used in new generation lithium polymer batteries and conducting polymers are used in sensors and flexible LCD displays.

Display technology

Detailed analysis of the electrical characteristics of LCD material under a variety of conditions to improve visibility, contrast and switching speed.

Ferroelectrics / Piezoelectrics

For the research of materials to be used in a wide range of applications including valve actuators in automotive engines and suspension systems.

Paints and Coatings

High impedance paints and coatings are used for the corrosion protection of a wide range of products in, for example, the food packaging, automotive, aerospace and chemical industries. Potentiostats are sometimes required for this application (refer to the Solartron Electrochemistry brochure for more details).

Composite materials

Curing mechanisms within epoxy materials can be monitored to ensure optimal strength and minimum curing times.

Electronic components

Investigation of components and semiconductor materials close to breakdown potential.

Civil Engineering

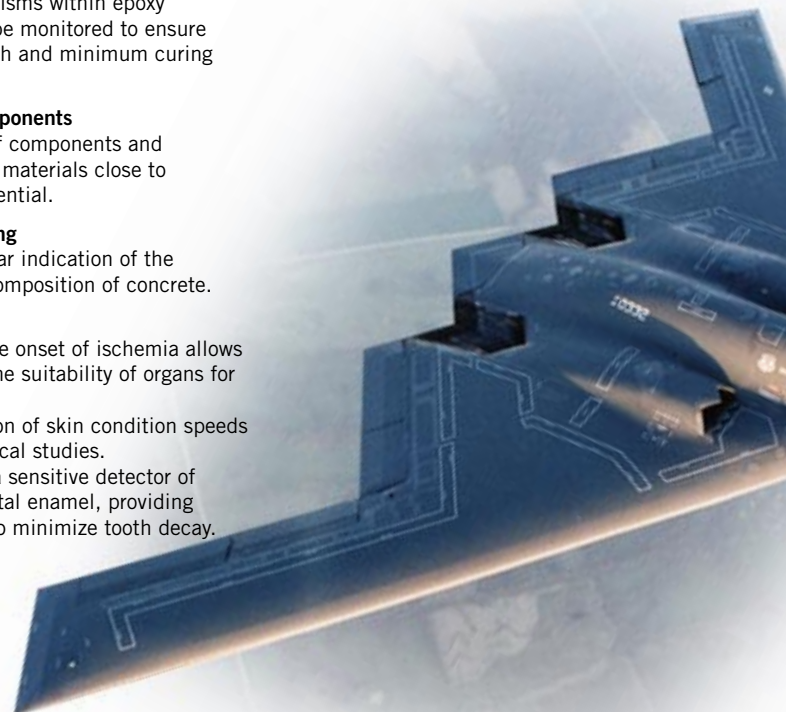
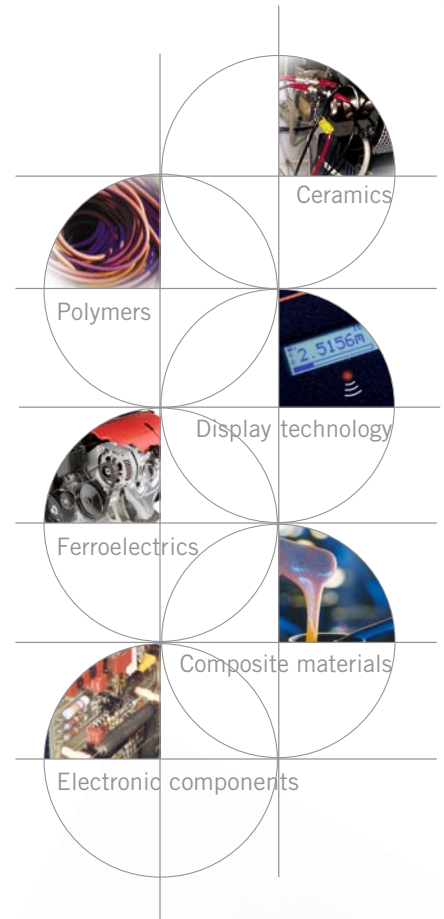
EIS gives a clear indication of the strength and composition of concrete.

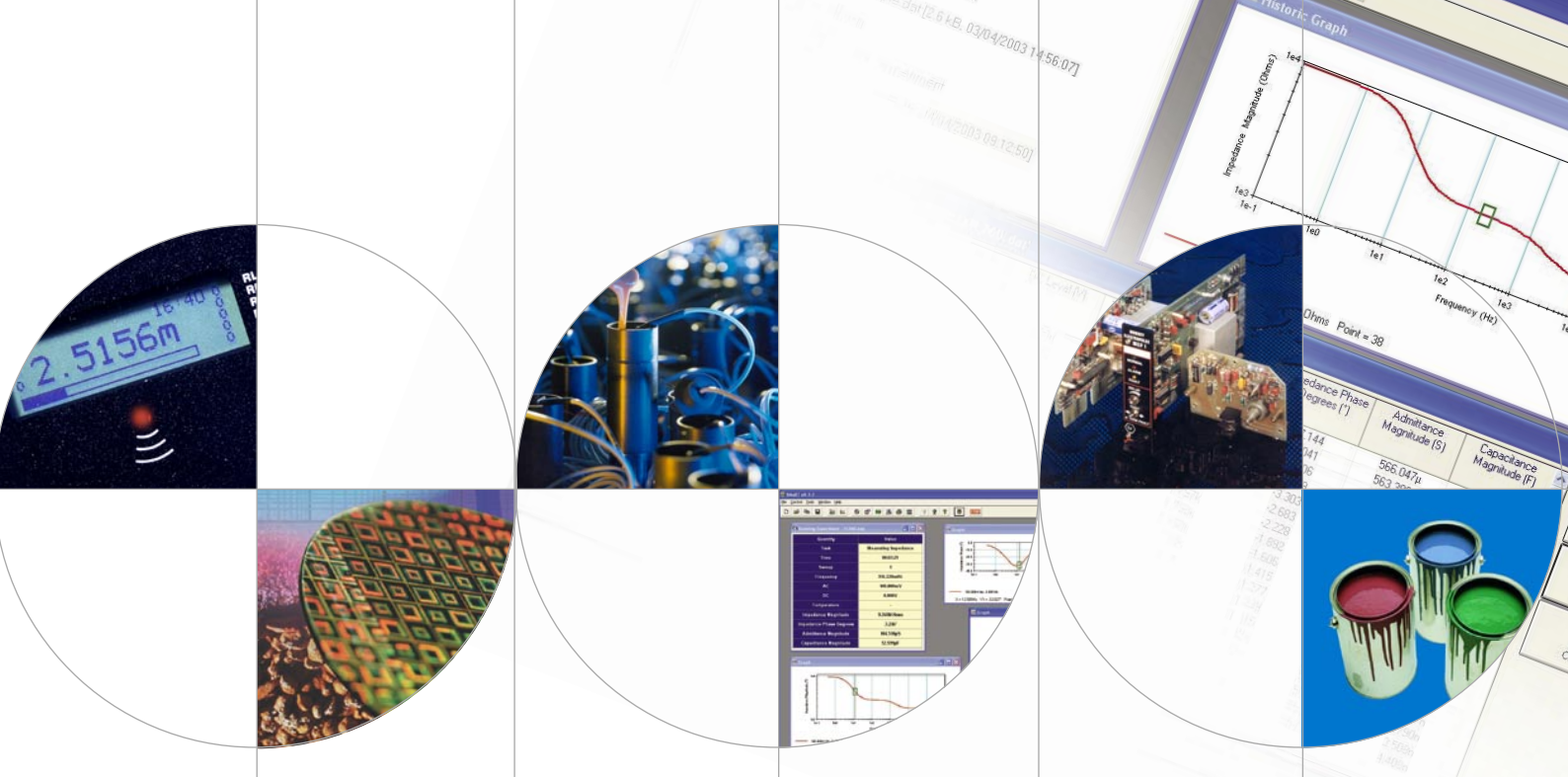
Biomaterials

Detection of the onset of ischemia allows evaluation of the suitability of organs for transplant.

Rapid evaluation of skin condition speeds up dermatological studies.

Impedance is a sensitive detector of damage to dental enamel, providing opportunities to minimize tooth decay.





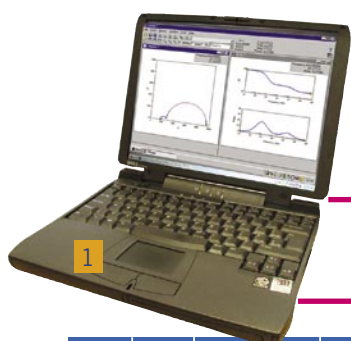
Components of a materials characterization system

1 PC provides set up and control of the system, data display and storage, via easy to use Windows-based software.

2 Frequency Response Analyzer (FRA) provides ac stimulus signal, and analyzes the response from the materials interface.

3 Dielectric/Impedance Interface effectively increases the sensitivity of the FRA, to enable more accurate measurement of high impedance/low capacitance materials.

4 Automatic temperature control (optional) for temperature critical investigations utilizing cryostats or furnaces.



1260 Impedance Analyzer - can be used stand alone up to 32MHz or with a 1296 or 1294. Built-in current converter 0.1%, 0.1° accuracy

1255A / 1255B - Cost effective alternative to 1260 (must be used with 1296 or 1294) The frequency range of 1255A is 20MHz and 1255B is 1MHz

1250 series FRAs frequency range up to 65kHz (must be used with 1296 or 1294)

1253 - Lower cost version of 1250 with 20kHz frequency range (must be used with 1296 or 1294)

10μHz 1mHz 1Hz 1kHz 1MHz 10MHz

1296/94 Dielectric/Impedance Interfaces

Designed specifically to provide high accuracy measurements with high impedance, low loss materials.

1296

Impedance range
100 to >100TΩ (10^{14})
tan delta < 10^{-4}
frequency 10μHz to 10MHz
Enables high ac signal and dc bias voltages (up to 1000V) to be applied to the sample, using external power supplies or amplifiers.

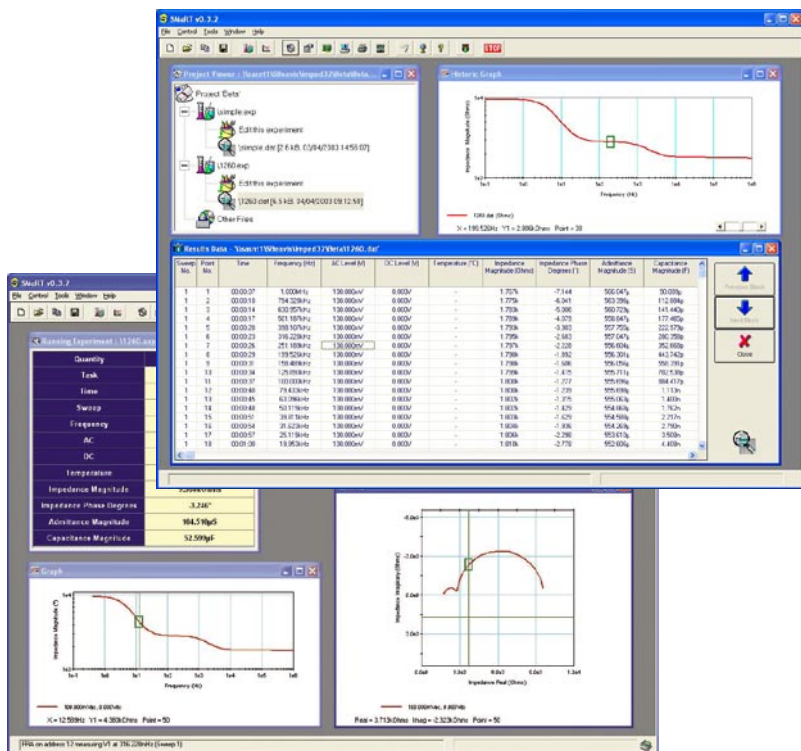
1294

Impedance range 10mΩ to 1GΩ
frequency 10μHz to >100kHz
4-terminal sample connections
IEC 601 connections for in-vivo investigations

1260/55/50/53 Frequency Response Analyzers

All Solartron's FRAs use a patented single sine correlation technique to minimize the effects of noise and harmonic distortion which plague lock-in and FFT-based instruments.

SMaRT (Solartron Materials Research and Test software)



Fully integrated Windows based PC software, providing control of frequency response analyzers, materials test interfaces and temperature control instrumentation. SMaRT allows complex sequencing of AC levels, DC levels, frequencies and temperatures providing the facilities for the complete impedance characterization of a wide range of materials. Measurement results can be displayed graphically in impedance, admittance, permittivity and electrical modulus formats against frequency, AC level, DC level, temperature or time. Bode and Complex Plane plot formats are available for the display of results. SMaRT runs on Windows 95,98, 2000 or XP.

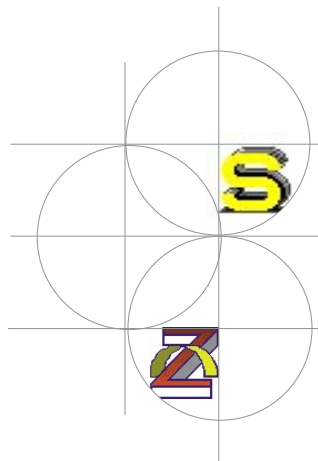
ZView Software

Data collected by SMaRT software can easily be imported into ZView for further analysis. ZView provides the most comprehensive set of facilities for the display and analysis of impedance data. Data may be presented in a wide variety of formats with trend overlays and can be analysed using very powerful equivalent circuit fitting routines. Virtually any circuit can be modelled using a wide variety of component types including resistors, capacitors, inductors, constant phase elements, distributed elements, Warburg elements etc.

Solartron Analytical is a world leader in instrumentation and software for the characterization of materials and electrochemical systems using precision electrical measurement techniques.

These techniques find particular use in the fields of corrosion, battery and fuel cell research, dielectric analysis and electrochemistry. The product portfolio includes industry standard frequency response analyzers, potentiostats, electrochemical software (Zplot and CorrWare) and battery test equipment.

Arun Technology, an operating unit of Solartron Analytical, provides a range of metal analyzers using optical emission techniques for determining elemental content. The units in static laboratory or mobile format are used in foundries, steelworks or scrapyards for metals analysis or material identification.



ZView is a trademark of Scribner Associates Inc.



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Solartron Analytical's
Quality System is approved to
BS EN ISO 9001: 1994

