characterized by an only apparently large polarization energy. The polarization energy, however, has no longer original physical meaning, and should be regarded as the solid-state relaxation energy including the contribution from additional interactions which are not observed in the weakly bound systems. Such additional inter-unit interactions are caused by 1) a multipole interaction, 2) a charge-transfer interaction, 3) a valence electron mixing, and so on. Now that these interactions are found to work efficiently, those systems have high potentialities to exhibit novel and/or eminent physical properties. As an example of so-called molecular design in expectation of an additional interaction working in the crystal, polythienoacenes are synthesized and examined [2, 3].

As the last group of organic systems classified here, strongly bound ones will be referred. Strong inter-unit interactions with a high anisotropy are characteristic of these systems, which consist predominantly of organic polymeric solids and include a few organic molecular solids confirmed so far [4]. Such systems often show the energy dispersion along the strongly coupled direction, e.g., one-dimensional energy band formation along the chain axis of long-chain alkanes, as could be examined by the angle-resolved ultraviolet photoelectron spectroscopy (ARUPS). Further, electronic relaxation energies in these systems are evaluated to be no less than those of mesoenergetically bound systems [5].

Thus, the magnitude and the dimensionality of inter-unit interactions will determine the nature of a particular system concerned. Information on the electronic structure of organic solids is therefore useful in developing new organic-based molecular systems with a view to realizing molecular electronic devices.

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The Scanning Dielectric Microscope

Koji Asami

A new instrument has been developed to image the local capacitance (or permittivity) and conductance (or conductivity) of colloidal particles and membranes in an aqueous environment.

Keywords: Dielectric image/ Dielectric relaxation/ Capacitance/ Conductance/ Colloidal particle/ Membrane

Electrical properties of colloidal particles including biological cells have been extensively studied by the dielectric technique referred to as suspension method. The method provides average electrical properties of colloidal particles which are extracted from the dielectric data of their suspension using an appropriate dielectric mixture equation. This method, however, is difficult to characterize individual particles. Hence, a new dielectric technique, termed scanning dielectric microscopy, has been developed. Capacitance and conductance are measured by the three-terminal method with a coaxial probe electrode, which is laterally scanned over samples on a plate electrode. The images of the local capacitance and conductance are obtained at frequencies between 1 kHz and 10 MHz, which enables the study of dielectric relaxation of individual particles and local areas of membranes.

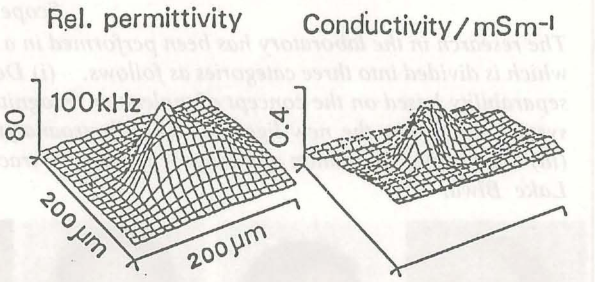

Figure 1. Dielectric images of a cultured MDCK cell in 0.3 M mannitol obtained at 0.1 MHz. The image area is 200 mm by 200 mm.