

and the South are: to define the magnitude of the problem, specifically of obesity and non-insulin-dependent diabetes mellitus (NIDDM) in several developing countries, to identify the vulnerable groups at increased risk, and to attempt to describe the metabolic and physiological mechanisms underlying this phenomenon. This CRP was thus set up with the following specific objectives:

- To promote the use of stable isotopic techniques to investigate the determinants of obesity and NIDDM in the identified countries.
- To identify the vulnerable groups at increased risk and to attempt to describe the metabolic and physiological mechanisms underlying this phenomenon.
- To enhance North–South collaboration and transfer of know-how and technology.

The important contributions of this CRP project can be broadly classified as (i) those that relate to validation of several

methodologies relevant to the various studies conducted in these countries using nuclear/isotopic techniques, and (ii) those that relate to the various associations of the measured parameters with the risk factors identified as being contributory or associated with these diseases. The common themes that emerged from this CRP project over the period of four years are: (i) The harmonization of methods and validation during the initial stages of this CRP has allowed conclusions to be drawn using data from many studies. (ii) The importance of environmental changes that accompany transition in societies (epidemiological, developmental, economic, socio-demographic and nutrition) which lead to a risk transition increasing risk of NCDs. Among these are rural-to-urban migration, variations in socio-economic status, etc. (iii) The differences noted in the different country studies may be attributed to different stages in this transition that different countries are currently at, while at the same time highlighting the

dual burden of under- and over-nutrition and their interactions that are evident in these societies in transition. They may also include differences due to differences in dietary intake and physical activity and their differential effects on risk.

These studies in several developing countries highlighted the role of dietary intake including variations in quantity, composition and quality of the diet and the relationship between body composition and physical activity patterns, while supporting our understanding of the conventional proximate and immediate risk factors. Some of the country studies which followed up the cohort showed an increase in risk factors and in disease manifestation over time along with changes in diet and in physical activity patterns, thus supporting the view that life-course events alter the risk of NCDs.

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MEETING REPORT

Symposium on electrets

The 11th International Symposium on Electrets (ISE 11) was held at Melbourne in Australia from 1 to 3 October 2002. The meeting was attended by 120 participants from all over the world. Among the 23 countries which were represented, the largest number of papers came from Japan, Germany, France and China. Portugal and India had five papers each. The Netherlands, Russia, Australia, USA and many others had less than five papers. The ISE 11 had technical sessions on injection, transport and trapping of charge, polarization; piezo-, pyro- and ferroelectric phenomena; molecular electrets and composite or novel materials; thermally-stimulated processes, radiation and field effects; ferroelectric ceramics, thin films, bioelectrets and applications. In all, 103 papers were presented. A workshop entitled 'Space Charge Profile Measurements – Practice, Problems and Potential' was organized on 4 October 2002.

The term 'electret' was coined by a Japanese physicist M. Eguchi in 1920s as an electric counterpart of magnet. Electret is a dielectric material containing a quasi-permanent electric charge trapped inside. The electret effect, first discovered in Carnauba wax obtained from a palm tree of Brazil, has come a long way with the introduction of polymers. The study of electret phenomena in polymers, their blends, polymer–ceramic composites and hybrid piezoelectric polymer films on micro-machined silicon dioxide layers have generated much interest and research activity in the past few years.

In the very first invited paper, J. van Turnhout (The Netherlands) described new approaches and a two-step method for the analysis of thermally stimulated currents, to find distribution of charge trapping states in polymer blends. In another paper G. M. Sessler (Germany) from Darmstadt University of Technol-

ogy presented a comparison of radiation-induced conductivity (RIC) and generation recombination (GR) models of charge transport in electron beam irradiated polymer electrets. J. Lewiner (France) has made important contributions in the space charge profiling for characterization of electrical behaviour in insulators. He with his group explored the possibility of applying this technique to semiconductors as well.

An invited paper by R. Gerhard-Multhaupt (Germany) on challenges in cellular and polymer foam electrets, covered a study of their nonlinear piezoelectric behaviour, thermal and temporal stability of charge as well as highlighted new application areas. Cellular polymer electret materials show quasi-ferroelectric behaviour and will remain the focus of research for next several years in development of devices such as electromechanical transducers, thermo-

electrical energy converters and microstructure elastomeric transducers. In Germany, several collaborations exist in this area with other countries including China, Portugal, Brazil and Russia.

Mechanism for charging and discharging in dielectrics and anomalous conduction in them were discussed by several authors. R. J. Fleming (Australia) described the space charge profile of titanium oxide doped polyethylene. In Australia, work on cross-linked polyethylene and study of aging effect in coaxial electric cables has been pursued. Structure correlation studies of charge decay and space charge characteristics in DC power cables made of low density polyethylene were provided by T. Mizutani *et al.* (Japan), J. N. Marat-Mendes (Portugal) and C. N. Rasmussen (Denmark). In another paper T. Mizutani *et al.* (Japan) presented the effect of blending low density polyethylene (PE) with polypropylene (PP). M. Wobbenhorst *et al.* (The Netherlands) applied positron annihilation lifetime spectroscopy and laser intensity modulation method (LIMM) technique to study space charge polarization in polycarbonate (PC) electrets. M. Goel (India) reviewed the electret materials and research activity in India from 1950s onwards and described a shift in focus from search for new materials and basic understanding of mechanism of polarization in them to characterization of tailor-made nano-materials and composites.

Polyvinylidene fluoride (PVDF) is proving to be a versatile material for electret transducers, microphones and other sensor applications. E. Fukada *et al.* (Japan) described the possibility of using poled PVDF films for sound insulation and vibration suppression. A paper by Q. M. Zhang *et al.* (USA) reported on electromechanical properties of PVDF-TrFE (trifluoroethylene) copolymer elec-

trrets being proposed for microelectromechanical system (MEMS) applications. Introduction of chlorofluoroethylene to make a terpolymer and use of electron irradiation techniques have been proposed to improve electro restrictive properties and reduce manufacturing cost. Organic solids as fillers lead to high performance composites.

With the advent of MEMS technology, a new era of electret applications is emerging. S. Trolier-McKinstry (USA) spoke on piezoelectric MEMS devices and possibility of integration of sensing and actuation functions in a single device using a single material. T. C. Goel *et al.* (India) presented piezoelectric properties of lanthanum-doped lead zirconium titanate (PLZT) ceramic films deposited on silicon chip, which could lead to development of microelectromechanical system (MEMS) pressure transducer. In a paper on integrated view of applications of electret technology in energy and health sectors, M. Goel described future possibilities of electrets in MEMS devices as *smart* sensors and in medical prosthesis as actuators. A number of other papers were presented on PVDF electrets. T. Furukawa (Japan), I. L. Guy (Australia), F. Bauer (France) and M. Wegener (Germany) described effect of material processing, characterization and electro-restrictive response as well as assessment of coaxial sensor cables made of PVDF.

Study of organic thin films as electroluminescent devices to replace liquid crystals was presented by S. Fujita and T. Tank (Japan). E. Motyl *et al.* (Poland) described the formation of most stable polymeric electrets in the composites of bronze and polytetrafluoroethylene. Study of triboelectrification in textiles and synthetic fibres were presented by K. Ohara *et al.* (Japan) and R. Kacprzyk (Poland). Z. Xia *et al.* and X. Zhang *et*

al. (China) presented electret studies in PVDF, composites of PVDF and chlorotrifluoroethylene, and PZT epoxy composites. Results on copper phthalocyanine and vanadium oxides as gas sensors were also reported. K. Arshak (Ireland) described structure correlation investigations of electrical properties of a thick film PVDF polymer.

S. B. Lang (Israel) in a novel interdisciplinary approach, investigated existence of piezoelectric transducers in the pineal gland of human brain. Another interesting paper in the biomedical field was on the possibility of using electrets in transdermal drug delivery by L. L. Cui (China). R. Nath *et al.* (India) discussed the mechanism of electret formation in polysaccharides and characterization aspects in biopolymers.

The International Symposium on Electrets (ISE) is held every three years. A beginning was made when the conference entitled 'Electrets and Related Electrostatic Charge Storage Phenomena' was held in October 1967 in Chicago, USA. ISE 12 is to be held in Brazil in 2005.

Noting the passing away of two stalwarts in the field of electrets, ISE 11 paid homage to Bernhard Gross known as 'father of the electrets' for his mammoth contributions and Dilip Das Gupta, who made important contribution in introducing LIMM for space charge profile measurements, besides conducting applied research on electrets at the University of Wales, UK. The Symposium instituted Memorial Lecture and Memorial Award in their memory.

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