

Design and fabrication of a time-of-flight spectrometer for studies of multiple ionization of gases by charged particle impact

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Pramana, 2002, **58**, 623–638.

The simplest TOF spectrometer consists of an ion source and a collector at the opposite ends of a vacuum tube. In a TOF spectrometer, collection could be fast, accelerating field pulses could be used and needs for precise machining are minimal. The authors report the indigenous Indian design of a TOF spectrometer and its performance in recording keV electron collisions with neon and argon gases. Typical values of time resolution and mass resolution were 10 ns and 10% respectively. The spectrometer could be used for studying keV electron collisions with gaseous atoms or molecules.

A reversible solid-state crystalline transformation in a metal phosphide induced by redox chemistry

D. C. S. Souza, V. Pralong, A. J. Jacobson and L. F. Nazar
Science, 2002, **296**, 2012–2015.

Typical crystalline transformation reactions at ambient temperature are kinetically limited and occur on geological time scales. Experiments reported in this paper demonstrate an unusual solid-state reaction at room temperature involving reversible insertion and extraction of Li into metal phosphides by redox reaction. SEM micrographs show the morphological changes accompanying insertions of Li into metal phosphides. Redox reactions were followed by galvanostatic titrimetry. The authors conclude that Li can intercalate into the metal phosphide crystals after cleavage of the covalent P–P bonds that can reform upon extraction of Li by reoxidation.

A new surface forces apparatus for nanorheology

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Rev. Sci. Instrum., 2002, **73**, 2292–2297.

Surface forces apparatus (SFA) is used to study mechanical properties of soft matter including rheological investigation of liquids. Usually such apparatus makes use of interferometric techniques on an optical mirror, the primary limitations

being the temporal resolution of the machine, and the availability of the transparent but optically smooth surface. The authors describe an original dynamic surface forces apparatus (DSFA) with two kinds of sensors – an interferometric, and a second capacitive sensor. With this novel design, use of almost any solid surface is now possible. As a test-case, the authors report the measurement of nanorheological parameters of dodecane liquid film.

The shape of a lying cord

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Am. J. Phys., 2002, **70**, 570–574.

The shape of a randomly lying cord could be predicted by developing stochastic differential equations involving two parameters, the length of the cord, and a constant proportional to the flexibility of the cord. The equations were simulated numerically and the results of the simulations compared to experimentally measured value. It was shown that the mean square of the distance between the two ends of the cord could be described by a simple algebraic equation containing the two parameters. The results would be useful for describing movement of microorganisms and motion of elementary particles.

Switchable Bragg diffraction from liquid crystal in colloid-templated structures

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Europhys. Lett., 2002, **58**, 679–685.

Liquid crystals were incorporated into periodic structures of polymers that used a template from the ordering information in self-assembled colloidal particles of 1.6 μm silica. The samples were sealed into ITO glass to form cells of approximately 25 μm inner thickness. The transmission and diffraction behaviour of the cell was studied under externally applied electric field. The composite material could be used to demonstrate three-dimensional Bragg Diffraction. Moreover, these structures could be used for switching electro-optic responses at higher electric fields and decreasing switching times. This appears to be the first report of electrically switchable three-dimensional Bragg diffraction. The material would find potential use for

making non-mechanical beam-steering and optical beam splitting devices.

A 77 k MOS magnetic field detector

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Rev. Mexicana F'isica, 2001, **47**, 558–561.

Design and performance of an integrated metal–oxide–semiconductor (MOS) based magnetic field detector is reported that is capable of measuring μTesla when operating at liquid nitrogen. Typically the device operates at a threshold voltage of 0.96 V with a power consumption of μWatt . The device is based on the principles of a MOS transistor, with a junction depth of 2.1 μm and a gate oxide thickness of 60 nm, in which the imbalance in the drain currents is proportional to the magnetic field density.

Brick production with dredged harbour sediments: An industrial scale experiment

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River basins get filled in quickly with the ever increasing loads of pollutants and municipal wastes in addition to the natural silts. Regular dredging of basins is practiced in all harbours to maintain navigation, the dredged sediment being usually deposited at ‘another landfill’. A better strategy in management of such solid wastes had been to recycle the sludge for the manufacture of bricks. The authors worked on the sediments dredged from the ports of Bremen (Germany) that typically generate 600 cubic metres of sludge annually and used this material in a brick factory near Hamburg (Germany). Typically 200 tonnes of dry harbour sediment from Bremen was mixed with other clays, dried in a stream dryer (temperature 400°C), and then dry-moulded in a press at a maximum pressure of approximately 200 bar. The moulds were incinerated at a temperature of 1050°C in an opposing motion kiln, exchanging approximately 1700 cubic meters of air in the furnace per ton of sediment. The exhaust water and gases were sampled and monitored for volatile and other pollutants. The bricks so manufactured passed the bio-safety requirements according to the prevailing environmental standards. This industrial scale experimentation recycled the solid waste into a durable and useful building material.