



St. Wilfred's College for Girls

(Affiliated to University of Rajasthan)

Report National workshop on Nanoscience and Nanotechnology

Organized by Department of Physic Workshop Organisation the workshop took place over a two-day period (12-12-2022–13-12-2022). Representatives from the organising institutions gave their perspectives on "Nanoscience and Nanotechnology". Thirty five (35) participants participated in the workshop. The programme included some keynote talks addressing expertise in nanoscience and technology. Patron., Dr. Keshav Badaya, Hon. Secretary, Wilfred's Education Society; Dr. Manisha Tiwari, Principal and Convener of the Workshop; Dr. Narendra Kumar Agrawal, organising secretary of the workshop (Head, Department of Physics and Ms. Dhawani Gangal, Co-Convener of the Workshop.

Inauguration Session This session starts with the welcome words of Dr. Keshav Badaya, Hon. Secretary, Wilfred's Education Society, Then, the Chief Guest, Dr. R. K., Singhal Director, CCT University of Rajasthan Jaipur, enlightened the audience with his wisdom words on the importance of the event. Dr. Manisha Tiwari, principal and convener of the workshop, gave an overview of the workshop. Then it was the turn of a luminary Dr. R. K. Singhal, Director, CCT University of Rajasthan, set the tone of the workshop with his key note lecture entitled "Overview of **Nanoscience and Nanotechnology Future Challenges**". In his talk, the past, present, and future aspects of nanotechnology were discussed in detail.

Technical Session I: This session was chaired by, Dr. R.K. Singhal, Director, CCT University of Rajasthan. In this session, there were three invited talks. The first lecture, entitled "Energy Harvesting Using Functional Materials," was delivered by Prof. Praveen Saraswat, HoD, Department of Physics, N.D. College Shikhoawad, and U.P. who introduced a very new concept to the participants. For decades, people have searched for ways to harvest energy from natural sources. Lately, a desire to address the issue of global warming and climate change has popularised solar or photovoltaic technology, while piezoelectric technology is being developed to power handheld devices without batteries, and thermoelectric technology is being explored to convert wasted heat, such as in automobile engine combustion, into electricity. Energy Harvesting with Functional Materials explains the growing field of energy harvesting from a materials and device perspective, with resulting technologies capable of enabling low power implantable sensors or a large-scale electrical grid. In addition to the design, implementation, and components of energy-efficient electronics, this lecture covers current advances in energy-harvesting materials and technology, including: high-efficiency solar technologies with lower cost than existing silicon-based photovoltaics; novel piezoelectric technologies utilising mechanical energy from vibrations and pressure; and the ability to harness thermal energy and temperature profiles with thermoelectric materials.

The second invited talk was something very interesting. Dr. Kavi Shankar Varshney, Associate Professor, Department of Physics, D.S. College, Aligarh, U.P., delivered the second invited talk on CNT. Carbon nanotubes (CNTs) are allotropes of carbon made of graphite and constructed in cylindrical tubes with a nanometre in diameter and several millimetres in length. Their impressive structural, mechanical, and electronic properties are due to their small size and mass, their strong mechanical potency, and their high electrical and thermal conductivity. CNTs have been successfully applied in pharmacy and medicine due to their high surface area that is capable of adsorbing or conjugating with a wide variety of therapeutic and diagnostic agents (drugs,



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genes, vaccines, antibodies, biosensors, etc.). They have been proven to be an excellent vehicle for drug delivery directly into cells without metabolism by the body. Then other applications of CNTs have been extensively performed, not only for drug and gene therapies but also for tissue regeneration, biosensor diagnosis, enantiomer separation of chiral drugs, and extraction and analysis of drugs and pollutants. Moreover, CNTs have recently been revealed as promising antioxidants. This mini-review focuses on the applications of CNTs in all fields of pharmacy and medicine, from therapeutics to analysis and diagnosis, as cited above. It also examines the pharmacokinetics, metabolism, and toxicity of different forms of CNTs and discusses the perspectives, advantages, and obstacles of this promising bio nanotechnology in the future.

Technical Session II: This session was chaired by Prof. Praveen Saraswat, HoD Department of Physics, N.D. College Shikhoawad, U.P., and India. There were two invited talks in this session. Prof. H. S. Palshaniya, Department of Physics, and University of Rajasthan Jaipur, delivered an invited talk on "Dosimetry using Nano Phosphors: Few Challenges and Solutions". A phosphor, most generally, is a substance that exhibits the phenomenon of luminescence. Somewhat confusingly, this includes both phosphorescent materials, which show a slow decay in brightness (> 1 ms), and fluorescent materials, where the emission decay takes place over tens of nanoseconds. Phosphorescent materials are known for their use in radar screens and glow-in-the-dark materials, whereas fluorescent materials are common in cathode ray tube (CRT) and plasma video display screens, sensors, and white LEDs. Phosphors are often transition metal compounds or rare earth compounds of various types. The most common uses of phosphors are in CRT displays and fluorescent lights. CRT phosphors were standardized beginning around World War II and designated by the letter "P" followed by a number. Dr. S. K. Gupta, Department of Physics and Dean Parishkar College of Global Excellence, Jaipur, India beautifully described the technological advancement at the nanoscale in his lecture, "Progress of science and technology at the nanometer scale."

The field of nanometer-scale science and technology (NSST) is very broad, ranging from nanoparticles, nanoclusters, mesoscopic systems, and Nano constrictions to individual atoms and molecules and their self-assembly into defined structures such as nanowires or biomolecules. This is a field where the border between traditional disciplines like physics, chemistry, and biology is no longer detectable and interesting synergies arise; e.g., instruments developed in physics provide the precision and sensitivity to perform specific molecular recognition experiments in biology. The roots of NSST go back to Feynman. The originator of the famous sentence "There is plenty of room at the bottom". His focus was on tools based mainly on electron microscopes. Taniguchi contributed to the roots by stressing the importance of the nanometer in precision mechanics. The breakthrough occurred with new types of microscopes (SPM), materials (carbon-based fullerenes, nanotubes, and quantum dots), mesoscopic systems, new trends in miniaturization based on the view of chemists, and the vision that nature is the best example of nanotechnology. In this discussion, it is of interest to know the answers to the questionnaire: "Significant scientific discoveries; significant technological advancements. Few quoted significant scientific discoveries were: the development of SPM and atom manipulation; the discovery of fullerenes, nanotubes, nanocrystals, and quantum dots; the demonstration of single electron devices at room temperature; the demonstration of molecular electronic devices; and biological examples of functional nanostructures: rotary motors, self- and non-self-recognition. The quoted significant technological advancements are: expansion of types and uses of SPM; Nano-lithography via molding and stamping as low-cost, high-throughput Nano



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patterning technologies with sub-10 nm feature sizes; micro-Electro-Mechanical Systems (MEMS) or Nano-Electro-Mechanical Systems (NEMS); high-speed AFM-based lithography.

Valedictory Session: This session started with an overview of the workshop by the organizing secretary, Dr. Narendra Kumar Agarwal. On the same lines, Dr. Kehav Badaya congratulated the organizers and participants for a wonderful event. Dr. Manisha Tiwari advised the organizers to organize the events frequently for the betterment of students at St. Wilfred' College for Girls. Our respected principal, Dr. Manisha Tiwari, also thanked all reviewers, speakers, and participants. Feedback was also taken by the principal, ma'am, which was very satisfactory. Ms. Dhawani Gangal, co-convenor of the workshop, gave a vote of thanks.



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