PHYSICS ADVANCED LABORATORY.

4.0 RESEARCH THRUST AND OBJECTIVES:

In line with the mission and mandate of the Sheda Science and Technology Complex (SHESTCO), the Physics Advanced Laboratory (PAL) is concerned with matter and energy-related studies, particularly their properties, inter-conversion and transformations.

To actualize the set objectives of the Complex, the Physics Advanced Laboratory is equipped for Research and Development (R&D) work in Materials Science and Applied Physics. This is in realization of the fact that only an optimal combination of the available energy, materials and skilled manpower can create the requisite environment for a sustainable economic development.

4.1 RESEARCH ACTIVITIES

4.1.1 MATERIALS DEVELOPMENT

This is aimed at the efficient exploitation and processing of the nation's solid mineral resources; to add value and thereby enhancing their foreign exchange potentials. The study of their physical, chemical and engineering properties is essential in determining their suitability for specific industrial applications.

The development of composite materials is fast gaining prominence. It is particularly attractive because of the limitless types of new materials that can be formulated by, for example, blending primary materials to produce composites from the elements, polymers, ceramics and organic materials. A notable offshoot and novel technology in composite materials development is Nanotechnology. PAL is working in concert with other agencies such as NASENI to fully exploit its application, particularly the peculiar and unique properties associated with nanomaterials.

ACTIVITIES

Establishment of the requisite indigenous technologies for producing bulk and thin film mechanical and electronic materials and devices and their characterization by mechanical, electrical, optical and magnetic means.

Development of Solid cooling elements as Peltier coolers for the production of Solid State refrigerators.

Composite preparation from polymer blends, etc.

Characterization and utilization of naturally occurring materials such as natural fibres, biomaterials, biopolymer and harvest residues.

Nanocomposite preparation through melt blending, polymerization, and polymer blending.

Physical property evaluation of materials, including minerals, materials composites and nanocomposites.

Modeling of materials and devices.

Developing skilled human capacity.

4.1.2 RENEWABLE ENERGY DEVELOPMENT

This is aimed at exploiting the renewable energy resources and optimization of their usage. The focus is on the production and characterization of organic and inorganic energy transducers. While the technology of inorganic- based energy transducers is well established, that of the organic- based transducers is still in its infancy. The ease of fabrication and its relatively low cost have also propelled the organic- based transducers to the frontline.

ACTIVITIES

Establishing the indigenous capacity for producing and characterizing organic- based solar cells (e.g. organic dye- sensitized and fullerene- based solar cells), and inorganic- based solar cells (e.g. crystalline and amorphous semiconductor- based solar cells).

Paneling of solar cells for micro, mini and macro power applications.

Promotion of photovoltaic as a viable form of energy in the rural communities of Nigeria.

Modeling of the optimization of generation, distribution and utilization of energy.

Building of skilled human capacity in the fabrication of devices and performance evaluation.

4.2 ACHIEVEMENTS OF PAL:

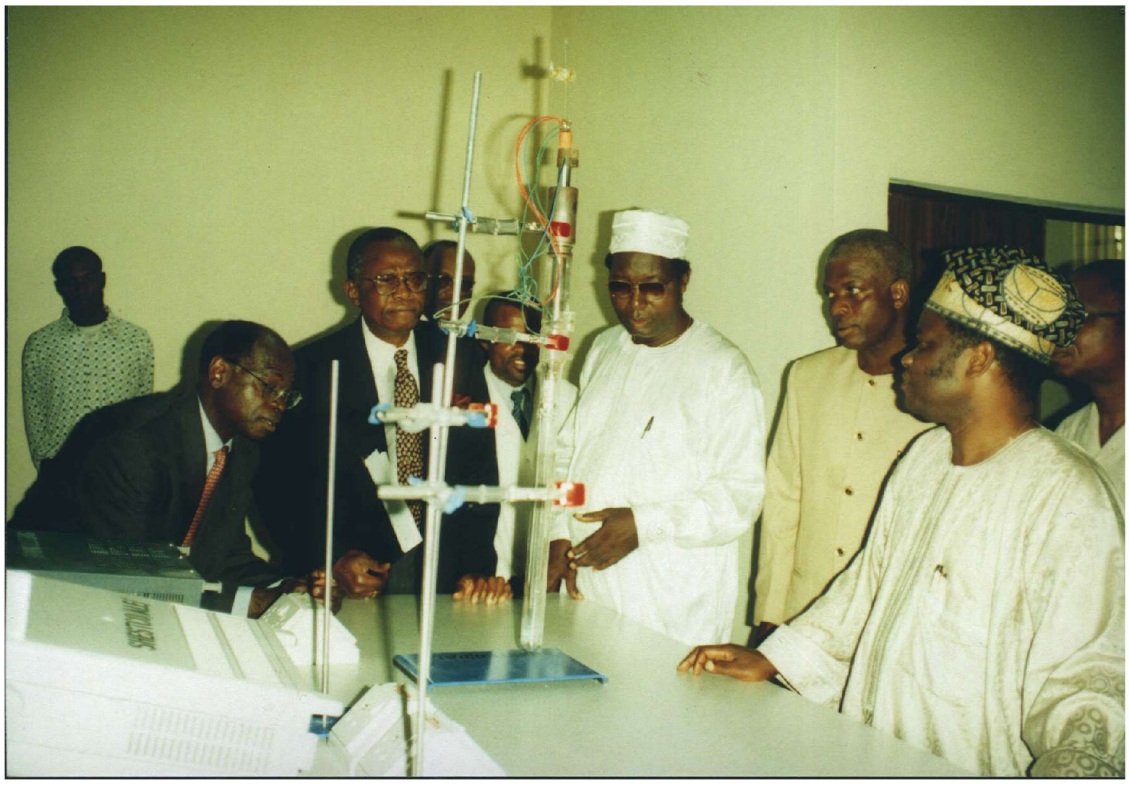
i. Development of methods for Atmospheric Chemical Vapour Deposition (CVD) and successful application for the production of transparent conductive coating of fluorine- doped Tin (IV) oxide.

Laboratory setup for Atmospheric CVD

An electrolyser for the production of Chlorine, Hydrogen and Sodium Hydroxide from Brine

ii. Development of a model electrolyser from the production of Chlorine, Hydrogen and Sodium Hydroxide. Various dimensionally stable electrodes are being investigated.

iii. Synthesis of various types of semiconducting nanocrystals for use in the fabrication of dye-sensitized solar cells.



Dr. Oberafo, Director, Physics Advanced Lab explaining research activities at the Laboratory to the visiting Honourary Presidential Advisory Committee on Science and Technology.

iv. Development of ultra porous industrial firebricks from locally available materials, for various uses.

Fabricated ultra-porous firebricks.

4.3 Collaborating Agencies

The Physics Advanced Laboratory collaborates with various national and international agencies in the performance of its R&D functions. Some of the organizations include:

i National Agency for Science and Engineering Infrastructure (NASENI), Abuja, Nigeria.

ii Engineering Materials Development Institute (EMDI), Akure, Nigeria.

iii Abdus Salam International Centre for Theoretical Physics (ICTP), Trieste, Italy

PAL also dispenses the educational component of its mandate by collaborating will all Physics Departments in Nigerian Universities. This entails collaborative research and supervision of graduate research.

4.4 Profile of the Director

Dr. Anthony A. Oberafo is the Director, Physics Advanced Laboratory. He had his undergraduate studies in Physicist from the University of Ibadan and graduated with Honours in 1971. He had his graduate studies in Solid State Physics at the University of London, where he obtained his MSc and Ph.D degrees in 1973 and 1976, respectively. Prior to his present appointment, which he assumed in 1998, he had lectured at the Department of Physics, University of Ibadan, Ibadan, Nigeria.Dr.Oberafo is an Experimental Physicist and a Fellow of both the Nigerian Institute of Physics and the Materials Society of Nigeria. He is an academic with research interests and expertise in Materials Science/Solid State Physics and Non-conventional Energy Resources Development.