

## Development and Experimental Analysis of Renewable Energy Devices Using Micro/Nano-Technologies

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### ABSTRACT

The covered work covers the state of the art- micro electronics in the area of renewable energy sector. From the literature survey done at various levels, a lot of research done in micro level for benefit nature has been mentioned. As the green chemistry and green environment to be boost with the miniature technology to be used, nano electronics field in terms of use of 1dimensional (quantum dot/nano particle) to 2dimensional (nano wire) to 3 dimensional(nano sphere) to 4dimensional materials (nano origami/bio mimic). A lot of potential at nano level will help in shaping the nature, human kind and environment using renewable energy. Since 1996 a lot of work has been carried on under the aegis of micro electronics, which face some problem in globalization and miniaturization. Under nano electronics domain, the challenges of cost to be well optimized.

### INTRODUCTION

Before coal as a fuel in mid of 19 century, most of the fuel was renewable. As around 8lakhs years ago, oldest renewable energy was came into existence. The source of this was bio degraded fossils. [1-3]

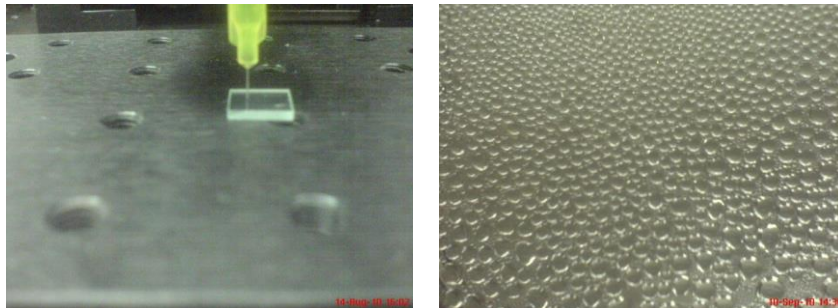
#### Renewable energy:

It is a kind of energy in which source and raw materials may be reused and/or recycle after every used. Sunlight, wind, rain, tides, water flows, waves and geothermal heat are some of the best examples of renewable energy. [4-7]The wastage in such kind of energy is quite less comparison to conventional one. Doubly fed induction generator wind turbine was used in earlier days to use as a source for energy generation. Electrical machines via electrical motor and electrical generators are well suited for various domains [8-9]. They also categorized as in various parallel domains is single phase, three phase, AC and DC generators. Wound and Squirrel cages are few of them. Asynchronous, synchronous, KWH, hybrid machines are the next one [10] in this follow up.

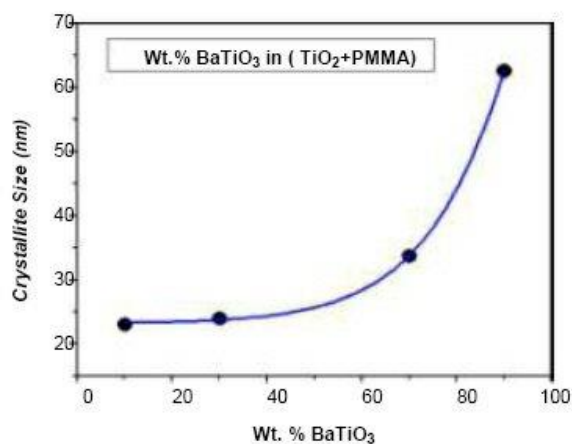
With the use of electronics and electrical domain knowledge, energy harvesting terms got its value in the area of energy. Energy lost may be saved in this domain.

#### Micro electronics in Renewable energy:

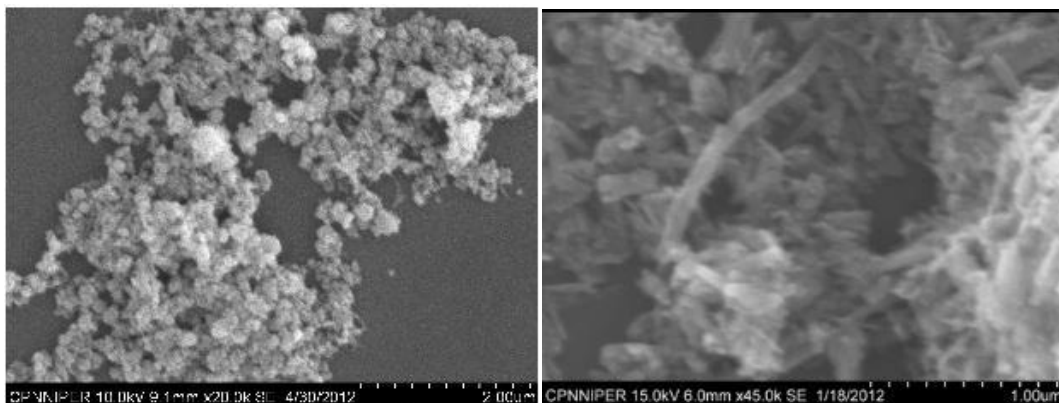
It is nothing but a design, control, automation and application at micron (1-100um or 1-100µm or 1 100µ i.e. 0.000001meter) level on physical dimensions. At micron level, maximum turbulence got vanished. Only laminar flow and stream line flow is main thing remaining in it. Various types of boundary conditions are applicable over it such as mass transfer, momentum transfer, heat transfer and population balance models are best suited in such kind of micro devices [11-13]. AC and DC micro grids i.e. DC and MG automations is being used under this category. In the same manner, there is tremendous growth in hybrid structure/devices. Organic, polymeric semiconductors are well suited in these areas. In last 5-10 years bottom gate/bottom contact (BGBC) FET are designed for renewable energy harvesting under the umbrella of micro electronics domain. Fig 1, 2 shows some diagrams created by using RoboCAD (model 4.51) and rapid prototype machine (Ohio, USA). It is a solution of various polymers at difference weight percentage. Their rheological properties are also well defined by using viscometer (Brookhaven) and rheometer (Anton Inc) [14-15]. Fig 3 is variation of size vs. wt%.



*Fig. 1: micro droplets, 2: rail of micro droplets*



*Fig. 3: Size vs. wt% topology*



*Fig. 4-5 TEM images of CdSe and CdS at various resolution and varying energy*

Nano electronics in Renewable energy: It consists of a design, control, automation and application at nano level (1–100nm i.e. 10<sup>-9</sup>meter) on physical level. At this level, surface to volume ratio reached at much high value. At this level, all the electrical, mechanical, structural and morphological properties are changed tremendously [16–18]. Fig 4,5 shows electronic shapes on nano level. Single layer MoS<sub>2</sub>, BaTiO<sub>3</sub> and TiO<sub>2</sub> with various polymers such as conducting and non conducting polymers are used at varying weight percentage. They are used as nano pores as nano power generators. [19] It will be benefited from its low cost, flexible scaling, shapes. Ferric oxide also is being used in this follow up in recent research. Their

microscopic properties are also well defined by using scanning electron microscopy (SEM) (Brookhaven) and Transmission electron microscopy (TEM) [20–21].

## RESULTS AND DISCUSSION

Various electron microscopic images are taken and they are compared with the existing conventional energy devices. Metal oxide and their compound such as CdSe, CdS, ZnS, ZnSe, TiO<sub>2</sub>, BaTiO<sub>3</sub>, Fe<sub>2</sub>O<sub>3</sub> and Al<sub>2</sub>O<sub>3</sub> are best one in energy harvesting for save earth and this globe. This also cut C/CO<sub>2</sub>-emission in numerous ways. Challenges are control at micron and nano levels

## CONCLUSION

With the use of novel nano and micro materials such as (nano particles, quantum dots, micron particles, micro beads, nano tubes and nano sheets such as 1D, 2D, 3D & 4D) are gaining their implementation in energy booster. This will confidently enhance the all benefit for mankind and environment under the aegis of renewable and sustainable energy in 21st century and in near future. Still some bottle neck in this emerging research areas are as follows: solar and wind energy is sometimes criticized for being variable entities & parasitic effects to optimize

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