

Group meeting report

Group talk was held on 20/04/2018. This was focused on the work plans and progress of the research exchange students from Coimbatore to HVL under the supervision of Prof. Dhayalan Velauthapillai.

Brief report

1. Dr. Akila

Topic: Hybridization of nanostructured TiO₂ DSSC and metal oxide-based carbon supercapacitors

Content: A photo supercapacitor, which is a device that couples a solar cell, typically a dye sensitized solar cell (DSSC), and an energy storage device such as a set of batteries, capacitor, or lately a supercapacitor, has generated considerable interest because of its superior photon-to-electricity conversion and in-situ energy storage abilities for future energy storage development. In the present work, nanostructured TiO₂ DSSC and metal oxide based carbon supercapacitors are hybridized for the efficient storage of harvested solar energy.

2. Dr. Azarudeen R

Topic: Research on the fabrication and characterization of 3D porous polymeric scaffolds for the bone regenerative applications.

Content: Bone tissue engineering is a promising approach to compete with these challenges and expected to replace most of the current clinical approaches that are merely transplanting autologous bones (autografts) or augmenting bone defects with synthetic materials (allografts). Poly(lactide-co-trimethylenecarbonate) (PLTMC) is a novel and ever reported material for bone tissue engineering using 3D printing architecture. Hence, it is printed as pristine and a composite was also made with nano hydroxyapatite (nHA) to analyze its performance. Moreover, to increase the hydrophilicity, silk fibroin was coated over the PLTMC and PLTMC-nHA to perform the enhanced activities. Followed by, the biomaterial was characterized by spectral, contact angle measurements, wettability tests, in vitro degradation, and biocompatibility, surface analysis by SEM, pore size distribution by micro-CT, nature observations by XRD, tensile strength assessed by mechanical properties, thermal stability by TGA & DSC and were extensively studied.

3. Venkatraman M.R

Topic: Low temperature synthesis of TiO₂ nanoparticles and its performance as Photo anodes in Dye sensitized solar cells.

Content: Generally, TiO₂ nanoparticles synthesis requires high temperature annealing for attaining high crystalline nature which is considered as a challenge for coating over flexible substrates. Here by we adopt a low temperature synthesis technique of temperatures <90°C for the synthesis of high crystalline TiO₂ nanoparticles. These prepared particles were mesoporous in nature which is considered as a very important characteristics of a photoanode.

4. Prabavathy N

Topic: Natural dye sensitized solar cells with TiO₂ nanostructures based photoanodes.

Content: Titania nanorods with rutile phase are prepared by hydrothermal method. This functions as photo electrode for DSSC. The aim of the project is to utilize natural dyes as sensitizers for DSSC. This minimizes the cost of the solar cell and the preparation is also easier. But the stability of dye is very short compared to synthetic dye. The factors affecting the degradation of dye are studied and improvements are taken to increase the photovoltaic performance of the cell using natural dye. Dye from rose flower is used as a sensitizer. Platinum is used counter electrode and iodine/ iodide as liquid electrolyte for DSSC fabrication. The following strategies such as using citric acid as solvent to extract dye, adding algal buffer layers on the TiO₂ film to improve the dye anchoring, preparing Ca doped nanorods to reduce the photocatalytic activity and utilizing algal co-sensitization to improve the dye stability were the measures performed to improve the solar performance of the cell from 0.67% to 2.3%.

5. Vinoth Pandi D

Topic: Formamidinium Lead Iodide Perovskite solar cells using low cost graphite as hole conducting layer

Content: The rapid improvement of perovskite solar cells has gained much attention in the photovoltaics world and of huge interest to the academic community. A perovskite solar cell

is a type of solar cell which includes a perovskite structured compound, most commonly a hybrid organic/inorganic lead or tin halide-based material, as the light-harvesting active layer. Here graphite was used as low cost hole conducting layer replacing high cost Spiro HTM's and gold back contact.

6. Akshaya SR

Topic: Identification and Synthesis of Silicon Carbide nanoparticles from biomass for solar cell application

Content: Silicon carbide is known for its unique properties like thermal stability, superior compressive strength, greater electrical resistance, breakdown electric field and saturated drift velocity and impurity ionization energies. In order to increase the total absorption spectra, TiO₂ can be doped by Silicon carbide ($2.0\text{eV} \leq E_g \leq 7.0\text{eV}$), which results in better conduction of electrons and reduces the recombination of electron-hole pair. So, using SiC obtained from biomass would be cheaper and effective.

7. Sudalai Manikandan

Topic: Modeling and Simulation in Bone Tissue Engineering

Content: Scaffold plays a key role in tissue engineering and an optimum degradation rate and enough mechanical strength are required during the regeneration of tissue.

The objective of the work is to present an optimal 3D structure of scaffold by developing mathematical model combines scaffold degradation, mechanical stimuli and bone regeneration using computational methods. The degradation of polymer occurs due to diffusion and hydrolysis reaction which results monomers with low molecular weight and low mechanical strength. The reduction in molecular weight over the time was modeled by understanding the concentration of functional groups remain inside the polymer matrix.