Glasnik hemičara i tehnologa Bosne i Hercegovine

Bulletin of the Chemists and Technologists of Bosnia and Herzegovina

2014

Special Issue

Print ISSN: 0367-4444
Online ISSN: 2232-7266

UDC: _____

Plenary lectures

PL-04

Conducting Polymers and their Applications

Levent Toppare

Department of Chemistry, Middle East Technical University, 06800 ANKARA TURKEY

Conducting polymers attracted great attention in many research fields owing to their overwhelming characteristics like ease of processability, ability of conduct electricity, low cost, straight forward preparation techniques. Our research interests are conducting polymer based electrochromic devices, solar cells, organic light emitting diodes and biosensors. Polymers having one of the three complementary colors (red, green, and blue) in the reduced state and high transmissivity in the oxidized state are key materials towards use in electrochromic devices and displays. For potential application of electrochromic materials in display technologies, one should have to create the entire color spectrum and this can be only achieved by having materials with additive or subtractive primary colors in their neutral states. To obtain a green color there should be at least two simultaneous absorption bands. Although the neutral state color is of great importance, the transmittance in the oxidized state is crucial too.

Biosensors based on conducting polymers have advantages over conventional laboratory based assays. The conventional methods are time consuming, expensive, required well trained personnel and not used for real time measurements. Nevertheless, biosensors are inexpensive, portable with minimized design, easy to handle, selective and sensitive. In our group, a wide variety of biosensors were emerged as conducting polymer based enzyme biosensors. For these purposes, many conducting polymers which have specific groups were designed and synthesized. These polymers were utilized as immobilization matrices for biosensor construction. During immobilization, several modification structures were used in biosensor fabrication to achieve the most effective surface design for target biosensors.

Solar cells basically convert sunlight into electricity. With the absorption of light donor molecule's electrons are excited from HOMO to LUMO to generate excitons. Excitons dissociate into holes and electrons. Electrons move through the acceptor molecule while the holes travel along the donor molecule. Charge carriers reaching to respective electrodes are collected. OLEDs on the other hand work oppositely generating light upon potential application. Recent developments in The Center for Solar Energy Research and Applications, METU on the OPVs and OLEDs are discussed.

Polimeri vodiči privlače veliku pažnju u različitim oblastima istraživanja zbog osobina kao što su laka prerada, sposobnost provođenja elektriciteta, niski troškovi i jednostavne tehnike pripreme. Područje interesa naše grupe su polimeri vodiči u elektrohromnim uređajima, solarnim ćelijama, diodama koje emituju svjetlost i biosenzorima.

Polimeri koji posjeduju jednu od tri komplementarne boje (crvena, zelena i plava) u redukovanom stanju i visoku propusnost u oksidovanom stanju su osnovni materijali koji se koriste u elektrohromnim uređajima i displejima. Za primjenu elektrohromnih materijala u tehnologijama proizvodnje displeja, neophodno je omogućiti stvaranje cijelog spektra boja što se može postići sa materijalima koji sadrže primarne boje u neutralnom stanju. Da bi se dobila zelena boja, potrebno je da

postoje barem dvije simultane apsorpcione trake. Iako neutralno stanje boje ima veliku važnost, propuštanje boje u oksidiranom stanju je krucijalno također.

Biosenzori zasnovani na polimerima vodičima imaju prednosti nad konvencionalnim esejima. Konvencionalne metode vremenski dugo traju, skupe su, zahtjvaju dobro obučeno osoblje i ne mogu se koristiti u realnom vremenu mjerenja. Sa druge strane, biosenzori su jeftini, prenosivi uz minimalan dizajn, jednostavni za rukovanje, selektivni i osjetljivi. U našoj grupi su nastali različiti enzimski biosenzori zasnovani polimerima vodičima. Za tu svrhu je sintetizirano mnogo polimera vodiča sa specifičnim grupama.

Ovi polimeri su se koristili kao imobilizacione matrice za konstrukciju biosenzora. U toku imobilizacije, nekoliko modifikacionih struktura je korišteno u fabrikaciji biosenzora da bi se postigao najefikasniji površinski dizajn za određeni biosenzor.

Solarne ćelije prevode sunčevu svjetlost u elektricitet. Elektroni molekule donora se apsorpcijom svjetla pobuđuju od HOMO do LUMO stnja pri čemu nastaju ekscitoni. Ekscitoni disociraju na I elektrone. Elektroni se kreću kroz molekulu akceptora dok se šupljine kreću duž molekule donora. Nosači naboja dospijevaju do dogovarajućih elektroda gdje se sakupljaju. OLEDi sa druge strane rade na suprotnom principu sakupljajući svjetlo nakon određene, potencijalne aplikacije. Nova dostignuća u Centru za istraživanja solarne energije i njihova primjena , METU na OPV I OLED su predstavljena u ovom radu..