J Phys Chem Biophys 2017, 7:2(Suppl)
DOI: 10.4172/2161-0398-C1-020

Enzymatic bioelectrocatalysis for energy conversion applications

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Oxidoreductase enzymes have been employed for almost 5 decades in biosensors and for energy conversion in the form of biofuel cells. However, most enzymatic bioelectrodes in the literature utilize complex biofuels (e.g. glucose), but only partially oxidize the complex biofuel via the use of a single enzyme (i.e., glucose oxidase or glucose dehydrogenase). This presentation will detail the use of enzyme cascades at bio-anodes for deep to complete oxidation of substrates to improve performance (energy density, current density and power density), but will also focus on the importance of forming metabolons for substrate channeling in multi-enzyme cascades. This enzyme cascade will include natural metabolons (i.e. the Krebs cycle) and artificial metabolons utilizing DNA as a scaffold, as well as hybrid cascades with organic electrocatalysts. In this presentation, the author will discuss the importance of structural orientation of enzymes and enzyme complexation in enzymatic cascades for efficient bioelectrocatalysis.

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LiI-added poly(ethylene oxide)-based electrolytes with high performance for all solid state lithium battery

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With the rapid development of new energy resources industry, brings ongoing demand for high energy density lithium battery. All solid state lithium battery, which uses inflammable solid electrolytes to replace flammable liquid electrolytes, is expected to be a promising route to solving the safety issues of high energy density lithium battery. Poly(ethylene oxide) (PEO) based materials are widely considered as promising candidates of polymer hosts in solid-state electrolytes, however, its ionic conductivity has to be improve to meet the production requirement. Considering the dissociation ability of the lithium salt in the polymer plays a decisive role for the number of free ions and hence to improve lithium ion transport transmission. LiI as well as LiTFSI and Al_2O_3, as additives, were added in PEO electrolytes under acetonitrile solution. The ion conductivity of prepared electrolyte can reach 1.18X10-3 S/cm, which was 5 times than the sample without LiI. The transfer number of prepared electrolyte was 0.47. The all solid-state lithium battery was fabricated with $LiFePO_4$ as cathode with the prepared electrolyte as binder. The LiI was supplied as reversible capacity for battery from the CV curve and charging and discharging curve. The cell test shows the discharge specific capacity was maintained 170 mAh/g and during 100 cycles with the columbic efficiency retained above 95%.

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