Nanocrystalline Diamond Electrode for Dye-Sensitized Solar Cells

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The B-doped nanocrystalline diamond (BDD) can be considered as a promising alternative of p-NiO in photocathode in dye-sensitized solar cells (DSCs). Diamond films are attractive by their excellent chemical and electrochemically stability, optical transparency and favorable electrical properties. The electrochemical inertness of BDD is beneficial in view of the corrosive nature of certain electrolyte solutions used in DSCs. Nanocrystalline boron doped diamond films were grown by a microwave plasma enhanced chemical vapor deposition.[1,2] Electrochemical impedance spectroscopy provided the flatband potentials and concentrations of acceptors, which relate to the B-concentrations from the neutron depth profiling. Electrochemical cleaning of the surface from sp^2 carbon impurities was demonstrated by Raman spectroscopy.[1] Spectral sensitization of the nanodiamond surface was carried out by anchoring of dyes like 4-(bis-{4-[5-(2,2-dicyano-vinyl)-thiophene-2-yl]-phenyl}-amino)-benzoic acid (P1 from Dyenamo AB). In a two-step procedure, polyethyleneimine is adsorbed on hydrogenated diamond surface and subsequently modified with P1. The sensitized diamond exhibits stable cathodic photocurrents under visible light illumination in aqueous electrolyte solution with dimethylviologen serving as electron mediator.[3] In spite of the simplicity of the surface sensitization protocol, the photoelectrochemical performance is similar or better compared to that of other sensitized diamond electrodes which were reported in previous studies (2008-14).[4] Acknowledgment. This work was supported by the Grant Agency of the Czech Republic (contract No. 13-31783S).

References

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