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Functionalized polythiophene for corrosion inhibition and photovoltaic application

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Abstract

Conjugated polymers are encouraging substitute for creating clean and renewable energy for photoinduced charge generation and transport media in polymer solar cells (PSCs). Successful synthesis of a new solution processable n-type polythiophene based π-conjugated polymer (P3HT-CN) is done where polythiophene units are substituted by cyano groups through post functionalization approach of synthesized P3HT which is cheap, stable, easily prepared, and inert against ambient conditions and is expected to be a competitive candidate for the acceptor material in non fullerene acceptors (NFAs) PSCs against fullerene derivative and used as the highly efficient active layer in the bulk heterojunction (BHJ) which increase the donor-acceptor interfacial area through controlling the phase separation indicating device structure ITO/PEDOT:PSS/P3HT:P3HT-CN/Al. Photovoltaic measurement of this PSCs device based on P3HT:P3HT-CN demonstrate the PCE of 0.008% with an increased short circuit current density (J_{sc}) of 0.11 mA cm^{-2}. The thermal, optical, and electrochemical properties are examined in detail showing high thermal stability, absorbance in the visible part of the solar spectrum, higher charge carrier mobility, and also mixed type corrosion inhibitive behavior with 90 and 78% inhibitor efficiency for P3HT and P3HT-CN, respectively, built this class of material as smart which can be used for many other applications.

KEYWORDS

conducting polymers, electrochemistry, photochemistry

1 | INTRODUCTION

Recently energy scenario has been changed leading to substantial increase in energy demands.[1] Therefore, it necessitates the development of a global energy supply based on limitless resources, which should also generate less greenhouse gasses than the conventional energy sources or nonrenewable energy sources such as fossil fuel to reduce detrimental effect on the environment.[2] So many kinds of renewable energies have been proposed such as wind power,[3] hydroelectricity,[4] geothermal,[5] biomass,[6] hydrogen energy,[7] and solar cells[8,9] to name a few. Solar cell is an existing class of renewable energy technology, which can directly convert solar energy to electricity, have become one of the most promising candidates for addressing global energy issues[10] to minimize the greenhouse emission and our imprints on the environment.[11] Sun is the largest carbon-neutral energy resource which can be utilized. Solar cell devices based on inorganic semiconductors, though efficiently harvest solar energy, are not that much cost effective.[12] Among all alternative technologies, organic photovoltaic (OPV)

