ABSTRACT

Renewable energy has drawn industry's interest the last years. The most popular renewable energy solution and the easiest to be used from the mass population – like city home owners and small businesses is solar energy using photovoltaic devices to convert solar power to electrical. More specifically in United States the energy production from solar energy is growing faster than the non-renewable devices and it has shown 30% growth year-over-year. The main advantages of solar power compared to the other renewable sources is the low cost compared with hydro power or wind power converting methods and the ability to use otherwise "dead" space such as rooftops or empty valleys. Now with the appearance of new battery technologies and their push in the market by big and influential companies such as Tesla Motors drawbacks like the lack of sunlight and bad weather are minimized.

With the huge push on solar power organic photovoltaics have drawn a lot of attention from a large number of research units and big companies worldwide. The main advantages of organic photovoltaic devices (and organic electronics in general) compared to the conventional devices based on Silica and other materials is their ability of production from liquid solutions and adjustment for mass roll-to-roll printing. Additionally they are lightweight and cheaper than the conventional devices and can be printed on flexible substrates creating flexible – bendable devices with a broader line of use.

Research on Organic Photovoltaics (OPVs) has been focused in the increase of power conversion efficiency (PCE) with successful studies reaching the 10% mark. On the other hand, PCE is not a standalone factor for a successful OPV end-product. Another important factor for that goal is the resistance of these devices in harsh environmental conditions and thus their long term stability. This thesis focuses on lifetime analysis of inverted photovoltaic devices. Moreover the impact in OPV's lifetime of different hole transporting layer's wetting agents is studied and a reference device for lifetime studies is proposed. Subsequently the impact of different accelerated lifetime conditions on the proposed reference devices is presented and described.

Hole transporting layer PEDOT:PSS and its interaction with other device's layers is suggested as one of the main degradation reasons for inverted organic photovoltaics using different characterizations techniques. Based on that in the last part of this thesis a different hole transporting layer is studied under accelerated lifetime conditions and compared to the reference devices

Keywords: Photovoltaics, inverted organic photovoltaics, accelerated lifetime conditions, lifetime analysis, PEDOT:PSS.