

# ELECTRONIC POLYMER DEVICE RELATED RESEARCH IN THE OPTOELECTRONIC LABORATORY AT SALERNO UNIVERSITY

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The main focus of the optoelectronic laboratory of the Electronic Engineering Department at Salerno University is on material and device characterization for solar cells, sensor, memory and display applications. Recently the following arguments have been treated:

## **- Investigation of carbon nanotube / polymer composites**

The influence of the preparation conditions on the electrical, optical and mechanical properties of CNT / polymer composites, deposited by spin-coating, ink-jet printing, casting and extrusion-molding are under investigation. Possible applications as piezoresistive sensors, PTC elements, switching devices and transparent conducting films for use in solar cell and OLED technology have been demonstrated. Particular emphasis has been given on the impact of the polymer matrix on the nanotube-nanotube contact resistance and on the influence of thermal cycling with and without applied electric field on the conductivity of the composites[1].

## **- In-situ characterization of organic materials during processing and device degradation monitoring**

Optical monitoring of crystallization and polymerization of polypropylene and polyethylene with and without CNT's [2] and degradation monitoring of oxadiazole [3] based blue emitting organic light emitting diodes [4] and of polythiophene / fullerene based solar cells. Besides monitoring the classical LED and solar cell parameters, we measured periodically during device stress test under constant voltage or constant optical power conditions also more unusual parameters (e.g. reverse bias I-V characteristics, breakdown voltage and photocurrent spectra of LED's and light emission characteristics and photoluminescence under variable bias conditions of solar cells) that are often more sensitive to the degradation of interfaces.

## **- Influence of high energy particle irradiation on solar cells and solar cell materials**

The impact of high energy protons on solar cells and optoelectronic materials have been investigated in a wide energy range between 500keV and 24GeV. So far we investigated mainly all types of silicon based solar cells (crystalline and amorphous silicon single junction cells, micromorph TANDEM cells and amorphous on crystalline silicon heterojunction cells), but recently we started to investigate CNT / polymer composite layers. Despite the fact that carbon nanotubes itself are rather insensitive to proton irradiation, we found a notable conductivity decrease when irradiating the composites with MeV protons.

## **- Development of low-cost and compact measurement equipment for the characterization of solar cells**

Due to the necessity to monitor device parameters often in remote sites (e.g. high energy particle accelerators and field measurements on solar cells) we developed a series of measurement setups, where the data acquisition is mainly based on the PC audio-card and a simple interface electronics instead of bulky instruments (e.g. electrometers). The same precision and dynamic range as with conventional equipment has been achieved by frequency coding of the measurement signal and introducing of a frequency - offset. For example we performed LBIC mapping with this simple setup in order to detect device inhomogeneities [5].

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