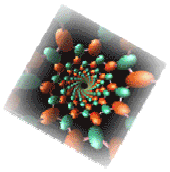

FIRST INTERNATIONAL NANOTECHNOLOGY CONFERENCE
ON COMMUNICATION AND COOPERATION

**Abstract**

**Organic Solar Cells: first large-scale application of nanotechnology?**

Many reports of public and private instances confirm the important role to be played by photovoltaics (PV) in future energy scenarios. It is predicted that electrical power supplied by renewable energy sources will cover 25-40% of the electricity demand in 2050. In the mean time, one can observe a steady growth of the yearly production of solar cells by more than 20% over the past 20 years and even more than 30% over the last five years. In 2004 the symbolic threshold of 1 GW has been crossed and the PV industry has become a multi-billion dollar economic sector with solar module cost around 3$/W and total system cost in the order of 6-7$/W. In order to start competing with conventional electricity supply, these costs have to come down by a factor 3 to 5, depending on the insulation conditions.

The present solar cell technologies are for the largest part (>90%) based on crystalline Si as the active material. In order to bring down the costs, crystalline Si can still go a long way, but for costs on the order of 0.5$/W, one will need a disruptive technology. In the past five years one can observe a fast progress in the domain of organic solar cells. This progress results from the use of cell concepts which differ fundamentally from the essentially planar homo- and heterojunction approaches prevailing in nowadays solar cells and relies strongly on the use of nanoscale phases to increase carrier collection. Organic solar cells offer the long-term perspective to reach the aforementioned cost objective for the following reasons: they are principally compatible with low-cost substrates like plastic foils; the amount of active material needed is one to two orders of magnitude lower than for crystalline Si; the cell and module processing only requires low energy input, and production up-scaling seems straightforward with additive techniques like film casting and printing.

The presentation will consist of 4 parts. In the first part, the PV-market will be described and the expected role of organic solar cells in this context will be discussed. In the second part, the basic mechanisms for the operation of organic solar cells will be shown with strong emphasis on the essential role of the active layer nanostructure. In the third part the main challenges to bridge the

gap between the nanoscale features of the cell and their large-scale implementation will be discussed. The fourth part will focus on the application of this technology for consumer-oriented applications for which efficiency and stability concerns are less stringent. It will be shown that for many applications where energy autonomy of miniaturized low-power electronic systems has to be ensured (“ambient intelligence”), organic solar cells are an efficient solution because of their inherent flexibility and low weight features.