EURYI Awards 2004

Press Information

Dr. Albert SCHENNING

– Chemical Engineering –

Project:

Supramolecular electronics by Oligonucleotide Templated Self-assembly of π-Conjugated Oligomers

A unique construction process for supramolecular assemblies in the 10-100 nm length scale that are connected to electrodes and act as (opto)electronic components is proposed. This unexplored field of research is proposed to be called supramolecular electronics. For the fabrication of these electronic devices, oligonucleotides will be used as a template for the construction of perfect-defined p-conjugated oligomer assemblies. p-Conjugated oligomers, in this case, oligo(p-phenylene vinylene) will be synthesized that contain a hydrogen bonding unit. This hydrogen bonding unit will be complementary to the single stranded DNA template. In such a way semi-conducting stacks will be constructed that are monodisperse, that is, have a specific number of building blocks. When using DNA with two different nucleotides and two different oligomers with the appropriate complementary hydrogen bonding units, well-defined stacks will be created in which the position of, for example, energy or electron donors and acceptors are directed by the template. These structures in solution are ideal systems to investigate fundamental issues within the nanometer dimensions like light harvesting, exciton diffusion length, energy and electron transfer processes and the conversion of light into chemical or electrical energy. The assemblies will be transformed to a solid support and sandwiched between electrodes. This will be done in several ways including oligonucleotides functionalized with thiol endgroups that can bind to two gold electrodes. These sandwiched architectures have potential applications in (nanosized) field effect transistors (FETs), photovoltaic devices, light-emitting diodes (LEDs), logic gates and biosensors. In order to wire these components, designed, inter-connecting patterns will be produced with dip-pen lithography. The tip of the AFM will be coated with p-conjugated oligomers and used to write lines of nanometers dimensions. In such a way this unique technology may lead to a future generation of nanodevices.

Comments:

This is a leading edge research proposal including very well defined multi-component systems which are anticipated to exhibit opto-electronic properties. It combines in an imaginative way advanced theoretical and applied research.

This is an outstanding young scientist with an extremely high productivity. The ability to act as an independent researcher has been proven by the many students he already supervised. He may clearly become world leading in this field.

The project proposes a unique, bottom-up approach of supramolecular chemistry for the construction of nanostructures. The chemistry of the proposal is relevant and concerns and also involves nucleotide recognition strategy. These materials will allow to interrogate molecular level opto-electronic response without the limitations of the disorder. Prognosis for success and for development of important technical applications is very high.

Eindhoven Technical University is one of the top-three cited Universities. The advantage of this institute is the complementary group of scientists (chemical engineers, material scientists and organic chemist). The candidate is already strongly collaborating in several activities like the present proposal.

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Current institution: Eindhoven University of Technology
New institution: Eindhoven University of Technology

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