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*Preface*

# Carbon Nanotubes: Exciting New Materials for Microanalysis and Sensing

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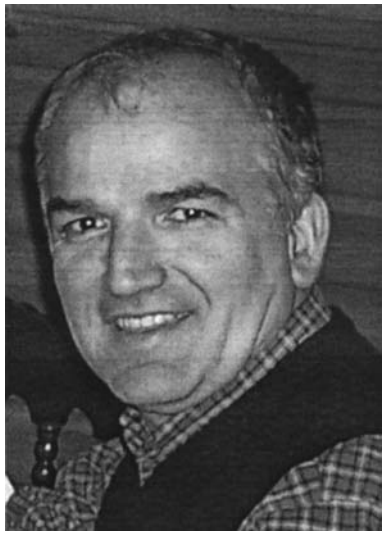

I am very pleased to introduce this special issue of Microchimica Acta dedicated to ''Carbon Nanotubes in Analytical Sciences''.

The history of being involved in this interesting field began on 2002 at New Mexico State University, working with Prof. Joseph Wang and Dr. Mustafa Musameh. It was through Dr. Yuehe Lin from Pacific Northwest National Laboratory at Richland that we received a small amount of the black and light powder, not yet commercialized, called carbon nanotube (CNT). We were so excited to see what this new product could bring in the field of electrochemical sensors. The easiest and fastest way to discover the expecting novel properties was to compare it with common materials used in this field. We discovered[1] that year that CNT-modified glassy carbon electrodes offered a stable amperometric detection of NADH, a cofactor involved in several hundred enzymatic reactions of $NAD^+/NADH^-$ dependent dehydrogenases. Moreover, the CNT-coating was offering a marked decrease in the overvoltage for the NADH oxidation and eliminating surface fouling effects.

From that time we have seen several hundred papers from laboratories around the world reporting interesting electrochemical properties even for enzyme, immuno and DNA sensing systems where CNTs were involved either to enhance the electron transfer or even as biomolecule immobilization platform or label carrier.

The small scale and the one-dimensional structure of CNTs are directly related to their unique properties which find more and more applications as the understanding and progress in synthesis advances. CNT represents an exemplary system where the bottoms-up approach to synthesis results in perfect structures with sizes of less than 10 nm, a range which remains inaccessible to advanced projection lithography techniques.

Nowadays, the applications of CNTs range from reinforcement of composites or conductive plastics to electrodes for batteries or flat screens, field effect transistors, chemical or force sensors and electromechanical memory. These applications have been demonstrated in bulk, on surfaces and on individual tubes.

[1] M. Musameh, J. Wang, A. Merkoci, Y. Lin, Electrochem Commun 4 (2002) 743–746

Nanotubes can be opened and filled with materials such as biological molecules, raising the possibility of applications in biotechnology.

The strength and flexibility of carbon nanotubes makes them of potential use in controlling other nanoscale structures, which suggests they will have an important role in nanotechnology engineering. A CNT integrated circuit, with a thousand nanotubes acting like transistors has been devised by IBM.[2] This was a huge accomplishment because it may dramatically lower the cost of high performance computers.

There are so many uses for the CNTs and the analytical chemistry community is not staying behind these research efforts. Several analytical applications of CNTs are being reported. This special issue is focused on some of the fundamental properties of CNTs and aims to provide some basic knowledge needed to follow the important developments in this field with interest for analytical applications. The issue includes only some of the works that researchers working in CNT application in analytical sciences as well as other related fields are currently performing.

I would like to thank all of the contributors that kindly accepted to collaborate in the preparation of this issue that hopefully will be of some help to the analytical science community.

*Arben Merkoçi*
Guest Editor

[2] P. F. Schewe, B. Stein, J. Riordon, Physics News 531, March 22, 2001 (http://www.aip.org/pnu/2001/)