## Research interests and Activities:

Most of Prof. Oren's past scientific activity focused on electrochemical-related issues. Within these activities it is possible to identify three different directions: studies in electrochemical methods in relation to treatment of water and waste-water, investigating mass transfer in electrochemical processes and investigating hydrogen transport to metals using electrochemical tools. Within the area of electrochemical water treatment processes, unique and pioneering work was conducted on understanding the electrochemistry of carbon and graphite electrodes, in particular, the double-layer behavior of these materials. Electrosorption of bacteria and colloidal particles and removal of heavy metals on these electrodes were also investigated.

Electrodialysis, which is also an electrochemically driven water desalination process, was studied in the early stages of Dr. Oren's scientific career Most of the work was directed towards the understanding of current distribution at different electrode shapes under diffusion limiting conditions and impinging solution jets.

Electrochemical studies conducted on the hydrogen-metal system have been devoted mainly to understanding hydrogen transport to a metal, through surface oxides. These investigations led to the development of the electrochemical-dilatometry concept, an extremely sensitive method for measuring hydrogen transport kinetics to and within metals.

Prof. Oren joined the Department for Desalination and Water Treatment, ZIWR, in May 2002, and in October 2002 he was appointed head of the group. Activities in which he is involved include electrodialysis studies; developing novel methods for preparation of highly conductive ion exchange membranes by using high electric fields; understanding transport mechanisms in RO and NF membranes using electrochemical techniques and measuring electrochemical phenomena; developing a novel, efficient water softening process as a pretreatment for membrane driven water treatment processes to reduce fouling and increase recovery.

Future investigations include electrical phenomena related to electrodialysis as well as to pressure driven membrane processes. Understanding the effect of the structure of heterogeneous ion exchange membranes on interfacial polarization and fouling is of prime importance with respect to optimizing electrodialytic water desalination. In addition, ion transport processes in the membrane inter-space, in particular when brackish water desalination is considered, will be a subject for intensive study. In pressure driven processes, particularly RO and NF, the importance of electrical phenomena originating from surface charges in the active layer in determining salt and organics rejection is recognized. These membranes are therefore also currently subject to intensive study. A continuation of earlier investigations into electrosorption towards water treatment is also planned, using novel types of high surface area conductive materials such as carbon nanotubes.

**Areas of Experties**

Electrochemical processes for preserving the environment, surface phenomena, electrodialysis for water treatment and desalination, ion exchange membranes, electrochemical phenomena in pressure driven processes for water treatment (Reverse osmosis, nanofiltration), capacitive deionization, electrochemical aspects in biofouling of membranes for water treatment.