Innovation technology of functional and protective coatings manufacturing

The present technology, namely VDS process, offers the advantages of traditional vacuum, plasma, laser technologies in controlling film structure at the atomic or "nano" level while providing for outstanding efficiencies of evaporation and deposition. In some applies the technology allows material deposition in controlling gas atmosphere or in air.

When compared to conventional deposition methods the VDS enables:

- the effective deposition of a variety of materials on a variety of substrates;

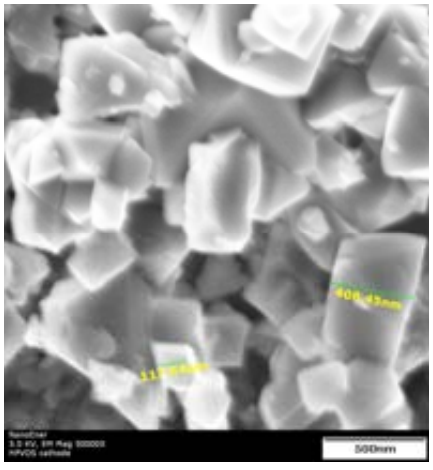
- the elimination of the need for binders while maintaining outstanding adhesion;

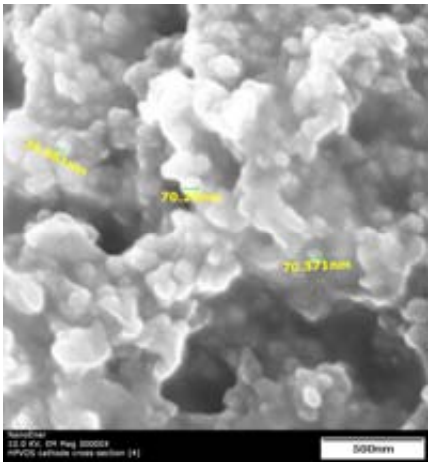
- the manufacture of a wide range of film thicknesses with fewer variations in thickness;

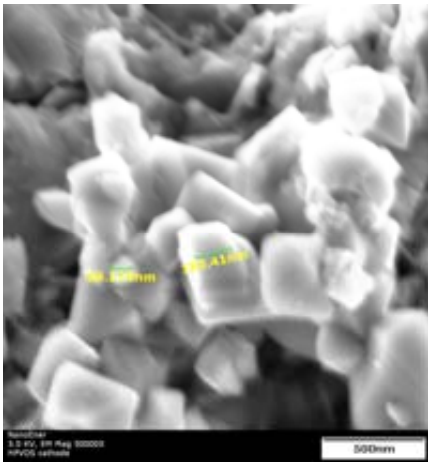
- the creation of nanostructured thin films having a more uniform surface with fewer surface defects;

- low cost of production.

VDS technology allows obtaining of high-density or porous ceramic or ceramic-metal coatings of determined thickness on metal or ceramic substrates. The rate of deposition is more than 100 μm/sec which is in 100-1000 times greater than in existing vacuum PVD, CVD technologies and 10 times greater compare with plasma and coating technologies of material deposition. Increasing of material mass transfer achieves by using of high-pressure vapor flow (traditional VDS technology), gas (vapor) flow with particles of initial material in liquid state (PVDS technology) and gas (vapor) flow with particles of initial material in solid state (HDS, HPVDS technology).





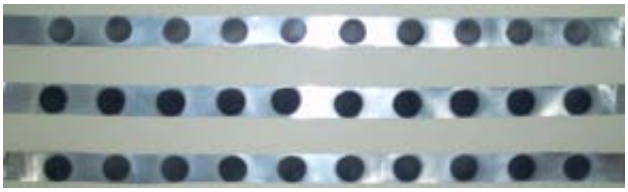


Structure of VDS electrodes

VDS technology was developed jointly with American companies Ener1 Inc. and its subsidiary NanoEner Inc. and now successfully applied in USA for new generation of electrodes manufacturing

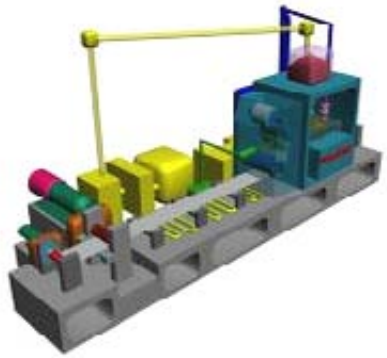
The present technology was initially developed for the production of nanostructured electrodes for high charge/discharge rate Li-ion battery electrodes for such challenging applications as hybrid electric vehicles and handheld power tools and super thin low cost primary and rechargeable batteries for active tags and other applications.

Pilot line for electrodes manufacturing



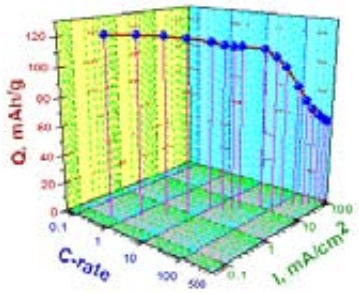
Electrodes samples

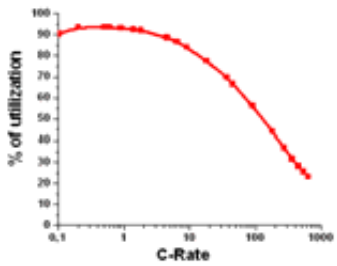
Present technology allows easy scaling-up for many industrial applications



Prototype of industrial apparatus for electrode tape manufacturing

Results of electrodes (active material $LiMn_2O_4$ spinel) electrochemical testing which have been obtained using the present technology demonstrate high level of capacity and C-rate





The expanding of unique VDS technology is possible in the following directions:

- **high efficiency thin-film photovoltaic solar cells for cost-effective renewable energy;**
- **fuel cell components;**
- **heat-resistant and high-temperature coatings;**
- **protective coatings;**
- **new generation of supercapacitors;**
- **thin film sensors allowing for more effective monitoring and control of temperature, illumination, and humidity;**
- **high-conductivity wires with low resistance enabling the mass production.**