

Hard X- and Soft X- PES Investigation of Nanostructured PEM Fuel Cell Catalysts

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Powering of electronic devices by microfabricated power sources, including micro-proton exchange membrane fuel cells (m-PEMFC), are being actually investigated in laboratories world-wide. The possibility of co-fabrication of a power source on the same substrate as the electric circuit offers many advantages, including a reduction in size and weight, increased processing efficiency, and lower cost. The important issue of planar type fuel cells is a preparation of large specific surface area catalysts grown by thin film deposition techniques which are compatible with planar technology.

Recently we showed by fuel cell activity and electron microscopy measurements the possibility of preparation of porous large surface and high activity nanostructured thin film catalysts by depositing the catalysts in form of Pt-Ce-O [1] solid solutions on different carbon substrates by magnetron sputtering. Figure shows example of CNTs coated by the porous Pt-CeO₂ catalyst film.

Chemical composition of the films was investigated by x-ray synchrotron radiation photoelectron spectroscopy in soft and hard X ray region. Resonant PES has been performed by measuring Ce 4f resonant profiles of both Ce⁴⁺ and Ce³⁺ states. The Pt-doped sputtered cerium oxide films contained high concentration of cationic platinum Pt²⁺ and Pt⁴⁺ which were highly active species for hydrogen dissociation to protonic hydrogen H⁺.

