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Tailoring nanostructured catalysts for electrochemical energy conversion systems

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Abstract

This review covers topics related to the synthesis of nanoparticles, the anodic and cathodic electrochemical reactions and low temperature electrochemical energy devices. The thermodynamic aspects of nucleation and growth of nanoparticles are discussed. Different methods of chemical synthesis such as w/o microemulsion, Bönnemann, polyol and carbonyl are presented. How the electrochemical reactions take place on the surface of the catalytic nanoparticles and the importance of the substrate is put in evidence. The use of nanomaterials in low temperature energy devices such as H_2/O_2 polymer electrolyte or proton exchange membrane fuel cell (PEMFC) and micro-direct methanol fuel cell (μDMFC), as well as recent progress and durability, is discussed. Special attention is given to the novel laminar flow fuel cell (LFFC). This review starts with the genesis of catalytic nanoparticles, continues with the surface electrochemical reactions that occur on them, and finally it discusses their application in electrochemical energy devices such as low temperature fuel cells or Li-air batteries.

Keywords: electrochemistry; laminar flow fuel cell (LFFC); Li-air battery; micro-direct methanol fuel cell (μDMFC); nanoparticles; nucleation; proton exchange membrane fuel cell (PEMFC); synthesis

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