Shape-Selection of Thermodynamically Stabilized Colloidal Pd and Pt Nanoparticles Controlled via Support Effects - DTU Orbit (08/11/2017)

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Colloidal chemistry, in combination with nanoparticle (NP)/support epitaxial interactions is used here to synthesize shape-selected and thermodynamically stable metallic NPs over a broad range of NP sizes. The morphology of three-dimensional palladium and platinum NPs supported on TiO2(110) was investigated using scanning tunneling microscopy. Well-defined Pd and Pt NPs were synthesized via inverse micelle encapsulation. The initially spherical NPs were found to become faceted and form an epitaxial relationship with the support after high-temperature annealing (e.g., 1100 degrees C). Shape selection was achieved for almost all Pd NPs, namely, a truncated octahedron shape with (111) top and interfacial facets. The Pt NPs were however found to adopt a variety of shapes. The epitaxial relationship of the NPs with the support was evidenced by the alignment of the cluster's edges with TiO2(110)-[001] atomic rows and was found to be responsible for the shape control. The ability of synthesizing thermally stable shape-selected metal NPs demonstrated here is expected to be of relevance for applications in the field of catalysis, since the activity and selectivity of NP catalysts has been shown to strongly depend on the NP shape.

General information

State: Published
Organisations: Department of Physics, Experimental Surface and Nanomaterials Physics, Ruhr-University Bochum, University of Central Florida
Authors: Ahmadi, M. (Ekstern), Behafarid, F. (Ekstern), Holse, C. (Intern), Nielsen, J. H. (Intern), Cuenya, B. R. (Ekstern)
Number of pages: 8
Pages: 29178-29185
Publication date: 2015
Main Research Area: Technical/natural sciences

Publication information

Journal: Journal of Physical Chemistry C
Volume: 119
Issue number: 52
ISSN (Print): 1932-7447
Ratings:
BFI (2017): BFI-level 1
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 4.48 SJR 1.948 SNIP 1.181
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 1.917 SNIP 1.268 CiteScore 4.68
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 2.027 SNIP 1.448 CiteScore 5.08
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 2.134 SNIP 1.439 CiteScore 5.14
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): SJR 2.514 SNIP 1.46 CiteScore 4.98
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): SJR 2.32 SNIP 1.457 CiteScore 4.92
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 1
Scopus rating (2010): SJR 2.438 SNIP 1.356
Web of Science (2010): Indexed yes
BFI (2009): BFI-level 1

Scopus rating (2009): SJR 2.128 SNIP 1.417
Web of Science (2009): Indexed yes
BFI (2008): BFI-level 1
Scopus rating (2008): SJR 1.856 SNIP 1.033
Web of Science (2008): Indexed yes
Web of Science (2007): Indexed yes
Web of Science (2006): Indexed yes
Web of Science (2005): Indexed yes
Web of Science (2004): Indexed yes
Web of Science (2003): Indexed yes
Web of Science (2002): Indexed yes
Web of Science (2001): Indexed yes
Web of Science (2000): Indexed yes
Original language: English
DOIs:
10.1021/acs.jpcc.5b09980
Source: FindIt
Source-ID: 2289518553
Publication: Research - peer-review › Journal article – Annual report year: 2016