Size-Dependence of the Melting Temperature of Individual Au Nanoparticles

Nanoparticles have an immense importance in various fields, such as medicine, catalysis, and various technological applications. Nanoparticles exhibit a significant depression in melting point as their size goes below ≈10 nm. However, nanoparticles are frequently used in high temperature applications such as catalysis where temperatures often exceed several 100 degrees which makes it interesting to study not only the melting temperature depression, but also how the melting progresses through the particle. Using high-resolution transmission electron microscopy, the melting process of gold nanoparticles in the size range of 2–20 nm Au nanoparticles combined with molecular dynamics studies is investigated. A linear dependence of the melting temperature on the inverse particle size is confirmed; electron microscopy imaging reveals that the particles start melting at the surface and the liquid shell formed then rapidly expands to the particle core.

General information
State: Accepted/In press
Organisations: Center for Electron Nanoscopy, Experimental Surface and Nanomaterials Physics, Department of Physics, Theoretical Atomic-scale Physics, Technical University of Denmark
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Number of pages: 7
Publication date: 2019
Peer-reviewed: Yes

Publication information
Journal: Particle & Particle Systems Characterization
Article number: 1800480
ISSN (Print): 0934-0866
Ratings:
BFI (2019): BFI-level 1
Web of Science (2019): Indexed yes
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Scopus rating (2017): CiteScore 4.38 SJR 1.656 SNIP 0.871
Web of Science (2017): Impact factor 4.384
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 4.01 SJR 1.468 SNIP 0.792
Web of Science (2016): Impact factor 4.474
BFI (2015): BFI-level 1
Scopus rating (2015): CiteScore 3.85 SJR 1.35 SNIP 0.793
BFI (2014): BFI-level 1
Scopus rating (2014): CiteScore 2.7 SJR 0.996 SNIP 0.556
Web of Science (2014): Impact factor 3.081
BFI (2013): BFI-level 1
Scopus rating (2013): CiteScore 0.6 SJR 0.231 SNIP 0.323
Web of Science (2013): Impact factor 0.537
BFI (2012): BFI-level 1
Scopus rating (2012): CiteScore 0.96 SJR 0.272 SNIP 1.039
Web of Science (2012): Impact factor 0.857
BFI (2011): BFI-level 1
Scopus rating (2011): CiteScore 0.77 SJR 0.251 SNIP 0.741
Web of Science (2011): Impact factor 0.489
BFI (2010): BFI-level 1
Scopus rating (2010): SJR 0.358 SNIP 0.761
Web of Science (2010): Impact factor 0.71
BFI (2009): BFI-level 1
Scopus rating (2009): SJR 0.404 SNIP 0.638
BFI (2008): BFI-level 1
Scopus rating (2008): SJR 0.393 SNIP 0.55
Scopus rating (2007): SJR 0.321 SNIP 0.678
Scopus rating (2006): SJR 0.426 SNIP 1.101
Scopus rating (2005): SJR 0.643 SNIP 1.097
Scopus rating (2004): SJR 0.385 SNIP 0.764
Scopus rating (2003): SJR 0.466 SNIP 0.885
Scopus rating (2002): SJR 0.205 SNIP 0.644
Scopus rating (2001): SJR 0.411 SNIP 0.759
Scopus rating (2000): SJR 0.755 SNIP 0.768
Scopus rating (1999): SJR 0.671 SNIP 0.76
Original language: English
DOIs:
10.1002/ppsc.201800480
Source: FindIt
Source-ID: 2443703188
Research output: Research - peer-review ; Journal article – Annual report year: 2019