

Supporting Information

Nanoclusters by Gas-phase Condensation and Their Size-dependent Properties

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Table S1: Summary of studies published to date on nanoclusters obtained using magnetron-sputtering based gas-phase condensation technique, along with their bibliography.

Ref.	Element	Size (nm)	Structure	Substrate	Comments	Year
1	(Diamond-like) C	10 – 20		Si, TEM grid	Field emission	2007
2	MoS ₂	50 to ~2000 MoS ₂ units		TEM grid	DFT calculation supported	2014
3	Ag	70 – 100 atoms		C ₆₀	Localized surface plasmon resonances (LSPRs)	2024
4	Ag	3 – 55 atoms		C ₆₀ , Highly Oriented Pyrolytic Graphite (HOPG)	Hot electron generation and relaxation dynamics by time-resolved two-photon photoemission (2PPE) spectroscopy	2021
5	Ag	21 and 55 atoms		C ₆₀	Visualization of surface plasmons propagating at the buried organic/metal interface	2020
6	Ag	1 – 73 atoms			High-power impulse magnetron sputtering (HiPIMS) technique and time-resolved measurements of nanocluster formation	2013
7	Ag	10 – 60			Assembled nanoclusters (NCs) into planar patterns or complex 3D structures	2019
8	Ag	~ 5.6		Si	Rapid thermal annealing and modeling	2010
9	Ag	10 – 90	Crystalline	Si	Growth, morphology, structures, and composition of silver nanocluster films on Si substrates	2009
10	Ag	~ 5.6		Si	Morphological evolution of films composed of energetic and size-selected silver nanocluster ions	2009
11	Ag	~ 28		Si	Growth, melting and recrystallization with modeling	2009
12	Ag	3 – 8	Crystalline	Si	Size effect on melting points	2006

13	Ag	< 10 nm		SiO ₂ , TEM grid	Plasmonic quantum size effects	2019
14	Ag	~ 3		IDE, TEM grid	Monitoring and modeling the deposition on surfaces by impedance	2021
15	Ag	~ 3		IDE	NCs integrated into layers of polymer films for reusable Electronic Tongues	2021
16	Ag	2.9 – 4.3		SiO ₂	Alumina embedded for stable surface plasmon resonance	2023
17	Ag	~ 11	Crystalline	TEM grid, quartz	CeO ₂ embedded for LSPR in visible region	2019
18	Ag	5 – 15		Si, quartz	Size control for Surface Enhanced Raman Spectroscopy (SERS) sensing	2011
19	Ag	8 – 30	Single crystalline	SiN _x , TEM grid	Thermal stability of silver nanoparticles embedded in a-Si	2015
20	Ag	1 – 20		SiN _x , TEM grid	SiN embedded NC with an additional surface plasmon resonance corresponding to higher angular momenta	2015
21	Ag	20 (1-8 for satellite)	Core-satellite	TEM grid	Planetary NCs around big NCs	2019
22	Ag	39-119 atoms			Production of silver cluster cations by electron impact ionization of neutral precursors	2012
23	Ag	6 - 20		Graphene, SiO ₂	Graphene FET device	2023
24	Ag	10 - 40	FCC	SiO ₂ , TEM grid	Wetting of surfaces decorated by Ag NCs	2021
25	Ag			SiO ₂ , TEM grid	Broadband SERS detection	2019
26	Ag			Al ₂ O ₃ , TEM grid	SERS enhancement	2022
27	Ag /AgPt	5 – 15				2021
28	Ag	~ 10		TEM grid, quartz	Multiscale fabrication and SERS applications	2010
29	Ag	~ 10		SiO ₂ , TEM grid	Particle size effect on SERS efficiency	2017

30	Ag	~ 10.4		SiO ₂	Broadband single molecule SERS detection	2018
31	Ag	~ 10.5		Quartz	Molecule concentration-specific SERS substrates	2013
32	Ag	~ 20		Quartz	Self-assembled silver nanocluster linear arrays with surface plasmon resonance	2006
33	Ag	~ 34			NC computing networks comprising of Ag/C _x O _y Hz core/shell and Ag nanoparticles at the percolation threshold	2024
34	Ag	281–321 atoms		TEM grid	Competition between several symmetries and nanoparticle morphologies around the given size	2021
35	Ag	4 – 20		GCE	Non-enzymatic hydrogen peroxide sensors	2013
36	Ag	5 – 10		Graphite	Size-dependent stability	2003
37	Ag	5 – 13		Graphene, TEM grid	Localized surface plasmon enhanced photocurrent	2019
38	Ag	5 – 40		Si	Glancing angle deposition (GLAD)	2015
39	Ag@SiO ₂	5 – 60		TEM grid	Ag@SiO ₂ nanoparticles with a well-defined surface coating and <i>in-situ</i> diagnostics	2023
40	Ag	6.7 – 10		Si	Surface plasmon resonance	2013
41	Ag	7 – 12		Glass	Coatings with hydrophobic to superhydrophobic character	2016
42	Ag	8.7 – 13.6		Si	Laer light scattering applied to obtain in situ time-resolved information on the location of NC trapping	2022
43	Ag	9		SiN _x , TEM grid	Thermal stability of monodispersed silver cluster arrays assembled on block copolymer scaffolds	2010
44	Ag	18 – 33		Si	Ag NC plasma resonance, <i>in-situ</i> UV-Vis spectroscopy	2019
45	Ag	21.8 – 28.6			Simultaneous plasma-enhanced chemical vapour deposition of hexamethyldisiloxane (HMDSO)	2020
46	Ag	25		Si	<i>In-situ</i> plasma enhanced chemical vapor deposition of a-C:H mixture with NCs	2017
47	Ag	56 ± 16		PEG	Ag NPs into liquid poly(ethylene Glycol) and proposed use as novel memristive media	2023
48	Ag	1 – 10		Graphite	Size-selection; He carrier gas; immobilization of protein molecules	2003
49	Ag	5 – 15		TEM grid	Effects of the experimental parameters (e.g. gas flow	2012

					rate) on the NC size distribution	
50	Ag	3 – 15 atoms		TiO ₂	Atomically precise synthesis and mass filtering (in a liquid-nitrogen cooled condensation chamber)	2014
51	Ag	4-8		SiO ₂	Biological response	2018
52	Ag	12 – 20		Glass	Kinetic Monte Carlo (KMC) simulations of the growth of NCs	2018
53	Ag	6 – 12	Crystalline	ZnO:Ag	Sensor for Volatile organic compounds (VOCs)	2019
54	Ag	24.7	Crystalline	Si-glass	Plasmonic efficiency enhancement in a-Si solar cell	2019
55	Ag	5 – 30		Si	Charging state investigation using electrostatic quadrupole mass selection (EQMS)	2019
56	Ag	50 – 100		Si	Time-resolve small angle X-ray scattering (SAXS)	2020
57	Ag	5	Single crystalline	Glass/FTO/TiO ₂ -MgO	Ag embedded MgO, Perovskite solar cell	2021
58	Ag	15 – 35		Si	<i>In-situ</i> UV-Vis analysis	2022
59	Ag			Au/Pt electrode	Memristor application	2022
60	Ag, AgCu	2 – 1000 atoms		TEM grid	Hollow cylindrical magnetron sputtering to enhance NC yield	2014
61	Ag/Au	4 – 9	Single element Au NCs, AuAg alloy NCs, Ag core-Au shell NCs	Si, TEM grid	Adjustable multi-sputtering source; Full-face erosion (FFE) magnetron sputtering	2018
62	Ag/Au, Ag/Pt	11, 9		SiO ₂ matrix	Memristor application	2019
63	Ag_2700			Graphene oxide film	NC immobilization	2006
64	Ag, Si	2.6 – 8.3, 2.9 – 7.4		Commercial polycrystalline solar cells, TEM grid	Ag NCs to enhance commercial solar cell efficiency	2013
65	Ag/Au/AgAu	6.8 – 11		TEM grid, quartz	Special target consisting of a gold ring attached onto a silver target.	2017

66	AgAu	2 – 8	Crystalline	TEM grid	Comparison between magnetron and laser vaporization source	2023
67	AgAu	3 – 10	Crystalline	TEM grid	Ag surface segregation in sub-10-nm bimetallic AuAg NCs	2023
68	AgPt			SiN _x	Memristive switching dynamics of an intermediate-scale AgPt NP	2022
69	Ag/plasma polymer	75 – 175		Si	Localized surface plasma resonance	2020
70	Ag/Pt	Ag ₉ Pt ₂ , Ag ₉ Pt ₃		α-Al ₂ O ₃	CO oxidation catalysis	2017
71	AgAu	2-30		Quartz	Composition control by operando optical emission spectroscopy	2020
72	AgAu, AgPt	3 – 18	Crystalline	ZnO:Ag	H ₂ and VOC sensor	2020
73	Ag-Cu	3 – 9	Janus or Ag@Cu core/shell	Undoped Si, Si ₃ N ₄ TEM grid	Bimetallic coalescence nanoparticle synthesis and characterization with molecule dynamics and Monte Carlo simulation	2016
74	AgSiFe	15 – 50	Multi-core/shell	Si, TEM grid	Magneto-plasmonic hybrid NCs	2015
75	Al	4 – 20		Glass, TEM grid	Al NC plasmon resonance shift to the visible with SiN and a-Si thin films	2016
76	Al	24 – 87 atoms			NC photoionization spectra and possibility of electron pairing at T ≳ 100 K	2015
77	Al	32 – 95 atoms			NC ionization energies and work function analysis	2015
78	Al	67 – 800 atoms			Near-threshold photoionization cross sections	2023
79	Al	19 ± 6		Si, TEM grid	Blue shift of the SPR band	2018
80	Al, Cu	~ 7		Carbon nanotubes, Si, TEM grid	Single-walled carbon nanotubes decorated with pure size-filtered NCs	2020
81	Al _n B _m	n + m = 11–14	Endohedral		DFT simulation	2023
82	Au	923	Crystalline with different geometries	TEM grid	Atomic structural control	2014

83	Au	561 – 742 atoms	Crystalline with different geometries	TEM grid	Molecular dynamics (MD) simulation study	2015
84	Au	2.5	Crystalline	ZnO NW	Biosensor for DNA and streptavidin by using a DNA aptamer	2019
85	Au	2 – 8	Core-satellite crystalline	TEM grid	H ₂ O introduction to produce core-satellite NCs, modeling the kinetic formation of the complex structures	2020
86	Au	2.5		Graphene device	NCs functionalized field-effect transistor biosensors	2020
87	Au	10 – 1000 atoms		QCM	Gas-dynamics; Computational fluid dynamics (CFD) simulation	2021
88	Au	~ 4	Icosahedral to single crystalline	TEM grid	Impact of oxygen on the morphology	2012
89	Au	5 – 10	Single crystalline	TEM grid	Quantitative measurement of surface self-diffusion	2012
90	Au	~ 5		SiO ₂	NCs embedded into PMMA for memory device	2015
91	Au	3 – 8		IDE	Selective detection of Hg ²⁺ traces in water	2015
92	Au	20.5k, 95.5k, 260k, 760k and 1.675 M amu	Single crystalline	TEM grid, glassy carbon	An optimum NC defined by size and shape for CO ₂ electroreduction	2024
93	Au	2 – 20	Single crystalline	TEM grid	Size-dependence of the melting temperature of individual Au NCs	2019
94	Au	1 – 5		TEM grid	Coalescence of Au NCs	2018
95	Au	~ 24	Crystalline	Glass, TEM grid	Increasing the optical absorption in a-Si thin films by embedding Au NCs	2018
96	Au	25		ITO	Formation of gold silicide around NC	2020
97	Au	55, 923 atoms	Single crystalline isomers	Graphene, TEM grid	Size-dependent propagation	2014
98	Au	1 – 6		TEM grid	NCs for use as mass standard	2008
99	Au	1.6 – 3.2		Cr	Assisted catalysis for ZnO nanowire (NW) wet growth	2015
100	Au	2	Single crystalline isomers	TEM grid	Cluster-cluster coalescence	2020

101	Au	2 – 5		Graphene oxide film	Alignment aid for cryo-transmission electron tomography	2015
102	Au	2 – 5	Single crystalline	TEM grid	Size-dependent melting point	2019
103	Au	2.1 ± 0.8		Glassy carbon (GC)	Catalysts for heterogeneous glycerol oxidation	2020
104	Au	3 – 7		PMMA-glass	Size-dependent plasmon resonance	2008
105	Au	3		TiO ₂	Photogeneration, charge transfer, and trapping	2021
106	Au	8		Glass	Measured and modeled optical coupling between closed-packed islands of core-shell quantum dots (QDs) and a patterned film of size-selected gold clusters	2008
107	Au	12 ± 2	Single crystalline	Single wall carbon nanotube	Surface enhanced plasma resonance	2023
108	Au	147, 309, 561, 923 atoms		Graphite	Enhanced immobilization of individual biological molecules	2014
109	Au	923 atoms	Single crystalline	Si, TEM grid	Multilayer stacking NC-polymer release layers sandwiching by carbon support layers	2017
110	Au	300 – 23000		TEM grid, quartz, polymethyl methacrylate, mica	Au NC plasmon preservation in these substrates	2007
111	Au _N ; Ni _M	N=20–100; M=10–300		Graphene oxide film	Pinning of size-selected gold NCs or nickel NCs on graphite	2005
112	Au, Pd	923, 2057 both	Single crystalline	TEM grid	Atomic structure effect on 1-pentyne hydrogenation	2014
113	Au/Ti	400000 amu (Au/Ti) and Au2057	Single crystalline	SiO ₂ , TEM grid	STEM study of sintering behavior under electron beam; DFT calculation of surface anchoring	2018
114	Au ₇ , Ag ₇ , Si ₇			Graphite	NC implantation into graphite (simulation study)	2003

115	Au, Ag	10000 ± 330, 3300 ± 170 atoms	Crystalline	TEM grid	Films of mixed gold and silver nanoclusters of well-defined size	2006
116	Au ₂₀	20 atoms		TEM grid	Au ₂₀ clusters fluctuated between different structural configurations	2012
117	Au	25, 38, 55 atoms		TEM grid	Mass determination of supported hexane thiolate monolayer-protected Au ₃₈	2010
118	Au	55 – 139 atoms	Single crystalline	Graphene	Structures of the clusters may re-arrange at the surface of the FLG film	2012
119	Au ₃₀₉	309 atoms	Single crystalline isomers	Single crystalline isomers	Combination of atomistic modeling with image simulation	2007
120	Au ₃₀₉	309 atoms	Single crystalline	TEM grid	Three-dimensional structure of NC with simulation	2007
121	Au ₅₆₁	561 atoms	Single crystalline isomers	TEM grid	Experimental determination of the energy difference between the Au isomers	2018
122	Au ₈₈₇	887 atoms	Decahedral	TEM grid	Atomic NC structure identification	2012
123	Au ₉₂₃	923 atoms	Single crystalline isomers	TEM grid	NC structure transformation under e-beam exposure	2012
124	Au ₉₂₃	923 atoms	Single crystalline isomers	TEM grid	Ultrafast structural dynamics in response to electronic excitations	2018
125	Au ₉₃₄			TEM grid	Gold adatoms observed on the surface of NC	2011
126	Au/Au/Pd	4 – 8	Multi-crystalline	Si	Adjustable size and stoichiometry of bimetallic (AgAu) and trimetallic (AuAuPd) NCs	2012
127	Au/Cu	2 – 8	Multi-crystalline	MgO powder	4-Nitrophenol reduction	2018
128	Au@Co	7.5 – 8	Co core with Au shell	TEM grid	Icosahedron Co core covered by face center cubic Au facets	2015
129	AuFe	~ 13.2	Core-shell	TEM grid	Spin glass core and ferro-ferrimagnetic shell system	2014
130	AuFe	4.7 – 7.9	Nonequilibrium chemically ordered L1 ₂ and L1 ₀ phase	Si, TEM grid	Structure dependent magnetic ordering	2014
131	AuPd	5	Core-shell	TEM grid	In-flight annealing	2010
132	AuPtPd	2.3 – 5.9	Crystalline	Silicon nitride	MD simulation of NC growth and investigation of the	2019

				(Si ₃ N ₄), TEM grid	parameters governing the nucleation and growth	
133	Au@TiO _x	5.5 – 6.5	Crystalline Au core with amorphous TiO _x shell	TEM grid, Si	Multi-magnetron source for single step formation with in-flight oxidation of the Ti shell	2017
134	BN	20 – 40	Non-crystalline	Si	Field-emission cascades	2008
135	C	3.5 – 8	Amorphous	TEM grid	Calibration of atomic balance with MD simulation	2010
136	CeO ₂	4 – 9	Single-crystalline fluorite	Si, TEM grid	Increasing Ce–O bond length with decreasing NC size	2017
137	CeO _{2-x}	~ 8.5	Crystalline	Si, TEM grid	Influence of the oxidation procedure on the NC reducibility	2016
138	Co	1.9 – 5.5	FCC	Si, TEM grid	Size effects on the magnetic anisotropy	2017
139	Co	300 – 9000 atoms	FCC	Si, TEM grid	Co-sputter Cu or Si to embedded NC into a matrix	2002
140	Co	8.5, 13	Crystalline	TEM grid	Coalescence of Co nanoparticles during in situ high-temperature annealing	2006
141	Co	~ 10		Si	Magnetic stray field imaging by magnetic force microscopy	2004
142	Co	~ 8		Si	Magnetic versus structural properties	2004
143	Co	10		Si, TEM grid	Optical and magneto-optical properties of Co nanoparticles embedded in a SiO _x dielectric matrix as functions of Co concentration	2011
144	Co	10.3		Si, TEM grid	Co NCs embedded in Au and V matrices	2013
145	Co	10.3 ± 1.8		Si, TEM grid	Co NCs embedded in a silicon oxide matrix	2011
146	Co/Au	2 – 24	Crystalline	Si, TEM grid	Binary magnetic NCs using high-power impulse magnetron sputtering (HiPIMS)	2018
147	Co/Au/Ag	3 – 9		TEM grid	Single-element Co, Au, Ag NCs, bimetallic AuCo, AgCo and AgAu NCs, ternary AgAuCo NCs with different core shell structures	2014
148	Co-CoO	~ 8	Crystalline	TEM grid	Role of the oxygen partial pressure in NC formation	2011
149	Co-CoO	3-10	FCC	Glass, TEM	Reactive gas phase condensation, magnetic properties	2009

				grid		
150	Co ₉₀ Cr ₁₀ and Co ₈₀ Cr ₂₀	5.59, 6.91		Si, TEM grid	Size threshold for the spontaneous formation of a segregated core@shell structure; magnetic evaluation	2002
151	Co-doped ZnO	~ 7.5	Crystalline	Si	Room temperature ferromagnetic and ultraviolet optical properties	2005
152	Co-doped ZnO	~ 20	Wurtzite ZnO	Si	Giant positive magnetoresistance	2008
153	Co-doped Cu ₂ O	4.2 – 8	Cubic	Si, TEM grid	Ferromagnetism	2007
154	Co-W	3 – 15	Various crystalline	Si, TEM grid	Solubility extension and phase formation in gas-condensed Co-W NCs	2013
155	Co-W	5.7 ± 1.8 and 7.7 ± 2.7	Various crystalline	Si, TEM grid	Structures and magnetic properties	2012
156	Co:CoO	1-7	Core-shell	Si, TEM grid	Size-dependent proteresis (clockwise hysteresis) in 3-4 nm core size range	2008
157	Co(Hf) & Co(Pt)	< 10	Crystalline	Si, TEM grid	Magnetism of dilute Co(Hf) and Co(Pt) nanoclusters	2012
158	Co/CoO	~ 6	Crystalline	Si, TEM grid	Exchange bias optimization by controlled oxidation	2017
159	Co/CoO	~ 5	Core-shell	Cu, TEM grid	Exchange bias properties of Co/CoO core/shell nanoparticles embedded in different Cu _x O matrices	2017
160	Co/CoO	~ 6	FCC	Si, TEM grid	High-vacuum annealing reduction	2014
161	Co/CoO-Ni	5 – 7			High temperature magnetic stabilization of Co NCs by an antiferromagnetic proximity effect	2015
162	Co ₉₅ Au ₅	2 – 10		AFM tip	Use of NC attached onto the AFM tip to enhance the resolution	2011
163	CoAu	10	Crystalline	Si, TEM grid	Thermal-induced diffusion at nanoscale	2013
164	CoPt	3 – 8	Various crystalline	Glass, Si, TEM grid	Ferromagnetic properties with annealing dependent coercivity	2003
165	Cr	5		PET	Strain-sensor (100 gauge factor or G.F.)	2014
166	CrO ₂	2 – 20	Crystalline	Glass, TEM	Ferromagnetic properties with enhanced coercive field	2008

				grid		
167	Cu	10-40		Si-Ti	Application of a high power pulsed hollow cathode technique to increase NC yield	2013
168	Cu	~ 7.5		Si	Pulsed magnetron source to increase NC yield	2014
169	Cu	5-10		TEM grid	Mathematical study of the quadrupole mass filter	2013
170	Cu	1 – 10			Effects of target erosion on the mass spectra	2012
171	Cu	5 – 12500 atoms		Si	Detailed introduction of the experimental set up of the NC source system	2009
172	Cu	~ 3.4		Si	Surface morphology and composition of NC films	2008
173	Cu	1 – 7		SiO ₂ , TEM grid	The Kondo effect in dilute Fe in Cu NC thin film	2013
174	Cu	Cu ₅ , Cu ₂₀	Ultra-nanocrystalline	Glassy carbon	Electrochemical behavior in the presence of N ₂ or CO ₂	2016
175	Cu	24 – 98 atoms	Crystalline		Photoionization yields, appearance energies, and densities of states	2015
176	Cu	1000-3000 atoms		Si	High energy NC impact on substrate	1994
177	Cu	~ 10		Si	Roughening of growth front	2002
178	Cu	4.7 – 14		PMMA-glass	Surface wettability modified by NPs	2021
179	Cu	1 – 30	Crystalline	SiN _x , TEM grid	Wide NC range synthesis by gas phase condensation	2014
180	Cu	10 – 30		Glass	Hard nanocomposite coatings by the pulsed PECVD combined with simultaneous deposition of Cu NC	2016
181	Cu	16 ± 2		Si, carbon cloth	Superhydrophobic or superamphiphilic nanocomposite coatings on filtration membranes	2019
182	Cu	5 – 10		Si	Size-controlled formation of Cu NCs in pulsed magnetron sputtering system	2011
183	Cu	10 – 40		Ti-Si	High yield hollow cathode for NC synthesis	2013
184	Cu	4 – 10	Poly-crystalline	Glass, Si	Controlled Cu oxidation from Cu, CuO through Cu ₂ O and their mixture during synthesis.	2018
185	Cu	10 – 40		Si	<i>In-situ</i> Small Angle X-ray Scattering (SAXS)	2018
186	Cu	5	Crystalline	CVD	Glucose biosensor	2018

				graphene		
187	Cu	Cu ₄	Nanocrystalline	Al-Si	CO ₂ conversion into C1 fuels	2019
188	Cu	10 – 150	Poly-crystalline, spherical, cubic	Si	Effects of the magnetic field in the sputtering source on NC formation	2019
189	Cu			Graphene on FTO	Glucose biosensor	2020
190	Cu	3 – 12 atoms	Nanocrystalline	ZrO _x	CO ₂ hydrogenation	2021
191	Cu	10 – 27		Si	Post cylindrical magnetron source and rotating magnetic circuit to increase the NC yield	2021
192	Cu	15 – 33		QCM	A mechanical time-of-flight filter built for measurement of velocities of nanoparticles exiting a gas aggregation source	2021
193	Cu	1 – 7 atoms		TiO ₂ , SnO ₂ , Al ₂ O ₃ , SiO ₂	Selective oxidative dehydrogenation of cyclohexane	2022
194	Cu	10 – 40		QCM	High resolution nanoparticle velocity measurement outside the gas aggregation source.	2022
195	Cu	5 – 25		Si, Al ₂ O ₃	Solar thermal collector applications	2022
196	Cu	3 – 7		Silica	Modeling of NC nucleation and growth based on classical nucleation theory	2010
197	Cu, Ag	2 – 7, 5 – 9	Crystalline	FET based on graphite-oxide	Non-enzymatic glucose sensor application	2017
198	Cu-Au	4.6 - 10.7	Crystalline	TEM grid	Bimetallic NC nucleation study	2012
199	Cu, Ag, Au, Fe@Au and Fe@Fe oxide core-shell	5 – 15	Crystalline		Hydrosol suspensions of elemental and core-shell nanoparticles by co-deposition with water vapour	2012
200	Cu, CuNi			Si	Moveable erosion zone magnetron	2024
201	Cu, Pd	4 – 8 atoms		Al ₂ O ₃ , Si, TiO ₂ , UNCD	Oxidative dehydrogenation of cyclohexane	2019
202	Cu, Ti	Cu: 10 nm;		TEM grid	Ar and Ar + O ₂ used for reactive sputtering	2011

		Ti: 13 nm				
203	Cu@hydro-carbon	16 – 24 nm		Glass, Si, TEM grid	In-flight plasma polymer coating	2017
204	Cu ₄ O _x and Cu ₅ O _y	Cu ₄ O _x (x = 2–5); Cu ₅ O _y (y = 3, 5)		Al ₂ O ₃ , ultra-crystalline diamond (UNCD)	X-ray absorption near edge (XANE) study of fluxionality, oxidation states, and size effects	2020
205	CuAu	2.6 - 3.7	Crystalline	TEM grid	Stability of NCs under air exposure	2012
206	CuO	4 – 12	Crystalline	Si	Effect of O ₂ flow on CuO NC synthesis	2017
207	Cu _x Sn _{1-x}	3 – 12		TEM grid	Single target sputtering and fine-tuning size and composition	2012
208	CuZn	7.7 ± 1	Various crystalline phases	TEM grid, glassy carbon	Dynamic behavior of CuZn nanoparticles under oxidizing and reducing conditions	2015
209	Fe	40		Carbon cloth	Magnetic NC self assembly into nanostructures with hydrogen evolution reaction (HER) application	2018
210	Fe	~ 11	Core-shell	Si, TEM grid	Surface spin polarization of Fe nanoclusters	2010
211	Fe	~ 6		Si, TEM grid	Soft magnetic Fe cluster embedded into FePt film	2005
212	Fe	~ 20		Plastic	Dramatic increase in stability and longevity of enzymes	2007
213	Fe	~ 20	Crystalline			2007
214	Fe	~ 18	Core-shell crystalline	Si	Radiation nanodetector	2018
215	Fe	7	Core-shell crystalline		Structural evolution due to annealing treatments	2003
216	Fe	20	Body center cubic	Polyethylene glycol (PEG) precoated glass slides, TEM grid	DNA immobilization	2013
217	Fe	10 – 20	Different crystalline with	SiN	MD and kinetic Monte Carlo (KMC) simulation	2016

			different shape			
218	Fe, Fe-Au	7.1 – 27.5	Crystalline	PVP on glass, TEM grid	NO ₂ detection; magnetron-plasmonic properties	2017
219	Fe/Ag-Si	core < 10, overall 15 - 45	Multi FeAg core by Si shell	PVP on glass	Single-step co-sputter gas-phase condensation	2014
220	Fe/Al/O	10.8	Fe core Al-O shell	Si, TEM grid	Single-step synthesis of soft magnetic alloy NCs	2014
221	Fe/Co	4 – 12	Good crystallinity with various phase	TEM grid	High-yield hollow cathode dc sputtering-based gas phase condensation system	2020
222	Fe/Fe oxide	20	Core-shell	TEM grid	Enhanced oxidation of NC through train-mediated ionic transport	2014
223	Fe/Fe ₃ O ₄	5 – 20	Core-shell	TEM grid	Morphology and oxide shell structure	2007
224	FeAu	5 – 15	Various crystalline core-shell	TEM grid	MD and Metropolis Monte Carlo (MMC) simulations, selective wetting of specific sites on Fe NCs by Au	2019
225	FeCo	10 – 18	Body center cubic	Polyethylene glycol (PEG) pre-coated glass slide	Protein immobilization	2014
226	FeCo-Au/Ag	10 – 20	FeCo core with Ag or Au shell	Au coated glass	High magnetic moment	2005
227	Fe-Fe ₃ O ₄ /FeN	3 – 16	Core-shell crystalline	Si	Oxide shell reduction and magnetic property changes in core-shell Fe NCs under ion irradiation	2014
228	Fe-oxide	2 – 100	Core-shell crystalline	TEM grid	Void formation during early stages of passivation	2005
229	Fe-oxide	3 – 30	Core-shell	Si, TEM grid	Size-dependent specific surface area	2006
230	Fe-oxide	2 – 100	Core-shell crystalline	TEM grid	Electron beam-induced thickening of the protective oxide layer	2007
231	Fe-oxide	~ 20	Core-shell	Si	Biocompatible and cancer treatment	2008
232	Fe-oxide	2 – 100	Core-shell crystalline		Magnetic NC conjugates for radioactive waste separation	2013

233	FePd	9	Single crystalline	SnO ₂ NW	CO sensing	2017
234	FePt	2 – 10	L1 ₀ order	Si	Tunable ferromagnetic hysteresis loop	2005
235	FePt	5.6 – 6.7	L1 ₀ , or FCC	TEM grid	Quantitative structure analysis of L1 ₀ -ordered FePt NCs	2007
236	Fe-Pt	~ 6		Si, TEM grid	Intracluster exchange coupling of two-phase Fe ₃ Pt and FePt NCs	2005
237	Fe, Co, Ni, Mo	~ 5	Crystalline	TEM grid	Coalescence of NCs	2005
238	Fe/Fe-oxide	3 – 100	Core-shell crystalline	Si, TEM grid	Size-dependent magnetization	2005
239	Fe/Fe-oxide	~ 12	Core-shell	Si	Magnetization measurements and X-ray magnetic circular dichroism (XMCD) studies	2014
240	Fe/Fe-oxide	10 – 35	Various crystalline core-shell	Si	Tetragonal-like phase in the Fe/Fe-oxide core-shell systems	2017
241	Fe ₃ C	33 ± 9		Si, TEM grid	In-flight plasma treatment of the NPs	2020
242	Fe ₃ O ₄	5.3 – 9.4	Core-shell crystalline	Si	<i>In-situ</i> study of nanostructure and electrical resistance of NC films irradiated with ion beams	2014
129	FeAu	10 – 15	Homogenous crystalline	TEM grid, sapphire	Structural and magnetic properties: spin glass behavior	2014
243	FeB	10 – 14		Si, TEM grid	Room-temperature superparamagnetism and the blocking temperature found at 17.5 K	2014
244	FeB	14 – 30		Si, TEM grid	Size-dependent morphology	2014
245	FeCr	~ 25	Core-shell crystalline	Si, TEM grid	Magnetic interaction in Fe/Fe-oxide NCs controlled by antiferromagnetic Cr-dopant.	2013
246	FeNi	5 – 10	Crystalline	TEM grid	Effect of oxidation on the near-surface lattice relaxation	2011
247	FePt	4.1 – 6.2	Icosahedral structures	TEM grid	Ion-beam induced destabilization	2005
248	FePt	6.0 – 7.7	Various crystalline	TEM grid, sapphire	Effect of thermal sintering in the gas-phase on the magnetic properties of FePt	2002
249	FePt	3 – 20	Crystalline	TEM grid	In-flight annealing temperature dependent crystalline ordering	2003
250	FePt	2.2 – 6.1	Crystalline	TEM grid	Oxygen-mediated suppression of twinning	2003

251	FePt			Si	Postdeposition organic coating of metallic nanoparticles	2004
252	FePt	5 – 6	Icosahedral crystalline	TEM grid	Structural stability of icosahedral FePt NCs	2009
253	FePt	~ 6	Decahedral crystalline	TEM grid	First-principle calculation of the structures and comparison with electron microscopy observation	2014
254	FePt	5 – 6	Icosahedral	TEM grid	Size-dependent surface reconstruction and a layer-wise relaxation of icosahedral FePt NCs	2008
255	FePt	5 – 6	Icosahedra	TEM grid	In-flight annealing and core-shell icosahedral NCs	2009
256	FePt	~ 6	L1 ₀ phase	SiO ₂ , TEM grid	Magnetic moment of Fe in oxide-free FePt nanoparticles	2007
257	FePt	~ 4	Single crystalline	TEM grid	Early stages of direct L1 ₀ FePt nanocluster formation	2010
258	FePt	~ 11		Si, TEM grid	Template-mediated assembly of FePt clusters under external magnetic field	2005
259	FePt	~ 4.5	High-anisotropy L1 ₀ structure	Si, TEM grid	Ferromagnetism	2004
260	FePt	~ 4.75	Crystalline	HOPG, Si, TEM grid	Co-deposition of FePt nanoparticles embedded in MgO with tunable coercivity in magnetic properties	2013
261	FePt	3 – 6	Crystalline	Si	L1 ₀ magnetic properties	2003
262	FePt, CoPt	4 – 5	L1 ₀ phase	Si, TEM grid	High-anisotropy NC films for high-density data recording	2005
263	FePt:C	~ 4	High-anisotropy L1 ₀ phase	Si, TEM grid	Rapid thermal annealing to produce L1 ₀ ordered FePt:C cluster films	2005
264	FePt/Fe	~ 8	BCC a-Fe	Si, TEM grid	Fe cluster/FePt matrix nanocomposite permanent magnets	2006
265	Ge	6 – 8	Crystalline	Si, TEM grid	Optoelectronic properties of p-i-n heterojunctions	2013
266	Ge	4 – 9	Crystalline	Si, TEM grid	Structural properties of Ge NC	2012
267	Ge	4 – 9	Crystalline	Si, TEM grid, quartz	Effect of Ge NCs size and host matrix on the optical bandgap	2013
268	Ge	~ 14	Coexistence of crystalline, polycrystalline, amorphous	ITO	Solar cell	2018

269	Ge	~ 5		ITO	Ge NCs embedded with α -Si for solar cell application	2020
270	Ge	12.7	Crystalline	Glass	Hydrogenation	2021
271	Ge	~ 6	Crystalline	ITO	Persistent quantum confinement in connected Ge quantum dots	2023
272	Ge	20 – 36	Diamond cubic (Fd $\bar{3}m$)	Si	Size-dependent work function	2021
273	Ge	7.1 – 14.7	Single crystalline	TEM grid, Au-Si	Size-dependent optical properties	2020
274	GeSb	8	Amorphous to crystalline	Au electrodes	Phase-change memory application	2012
275	GeSbTe	8 – 17	Ge ₂ Sb ₂ Te ₅	TEM grid	Size-dependent crystallization temperature	2016
276	Ge ₂ Sb ₂ Te ₅	9.8 \pm 0.5	Amorphous and crystalline	Cu	Effect of airborne hydrocarbons on the wettability of phase change NC decorated surfaces	2020
277	GeSbTe	9.5 \pm 1.1	Phase-changing material	Graphene	Dynamics of NC on the graphene support strongly influenced by hydrocarbon contamination	2018
278	Hf	6 – 20	Crystalline	TEM grid	Structural and morphological study	2018
279	HfN	10		SiO ₂ , TEM grid	Onset of optical absorption at wavelengths below 500 nm	2024
280	HfO ₂	7 – 12		Si	Paramagnetism	2013
281	HfO ₂			YBCO	Integrated pulsed laser deposited YBCO multilayer with HfO ₂ NC film to form biaxially BaHfO ₃ , and the enhancement of the pinning force density	2017
282	IrTaO	1.1 – 6.4		Polycrystalline Au support	High oxygen evolution reaction (OER) performance with long term stability	2022
283	ITO	3 – 6		Si, TEM grid	Conductivity study	2023
284	Mg	29 \pm 16	Crystalline	Pd thin film	NC hydrogenation and visualisation of the process	2022
285	Mg	3 – 40	Various core-shell	TEM grid	Influence of Ti on the formation and stability of gas-phase Mg NCs	2010
286	Mg	15 – 70	Crystalline	TEM grid	Introduction Cu/Ni into Mg NCs to improve thermal stability for H ₂ storage	2010
287	Mg	10 – 50	Core-shell crystalline	TEM grid	Thermal stability	2010
288	Mg	10-80	Hexagonal	TEM grid	HRTEM crystallography study	2006

			crystalline prism			
289	MgTi, MgNi, MgCu		Multi-core-shell	TEM grid	High thermal stability during production and hydrogenation	2014
290	MgTi, MgC, MgPd	12 – 35	TiC core-Mg shell, tetragonal MgPd	TEM grid	Introduction of H ₂ /CH ₄ as a reactive/nucleating gas and of self-nucleating Pd to induce nucleation of MgPd NCs	2017
291	MnO	4 – 8		Si	Oxygen evolution reaction	2018
292	M _m Si _n ^{+/-} (M = Lu, Hf, and Ta)	0.8 - 0.9	Metal-encapsulating silicon cage		Various metal encapsulating Si cages	2022
293	MnAu	2 – 5	L1 ₀ structure	Si, TEM grid	Structural and magnetic properties driven by asymmetric atomic migration	2014
294	Mo	2.5 – 30	FCC (<4 nm), bcc (>4 nm)	TEM grid	Introduction of He for size tuning, with a complete TEM study (<i>in-situ</i> annealing to examine structural dynamics)	2005
295	Mo	2.9		Polished Cu substrate	NC production by a magnetron sputter discharge combined with a gas aggregation source	1992
296	MoS ₂	2 – 10	Crystalline	TEM grid	Lateral time-of-flight (TOF) mass filter for size selection	2017
297	Mo, Nb, Fe, Co	2 – 10	Core-shell crystalline	Si, TEM grid	Coalescence and oxidation of transition metal NCs	2008
298	MoO ₃	5.4		IDE, Si, TEM grid	High-energy facets of the MoO ₃ NCs found to significantly enhance gas-sensing sensitivity, particularly for ethanol, ammonia, and toluene	2024
299	MoO _x	6.5		IDE, Si, TEM grid	Flexible MoO _x NP film-based humidity sensors	2023
300	MoS _x	5.5 – 6		GC, TEM grid	HER, both S-deficient or S-rich NCs	2018
301	MoS ₂ -Co	5.27 – 9.26		GC, TEM grid	HER	2020
302	MoS ₂ -Ni	2.6 – 5		GC, TEM grid	HER	2016
303	Nb	~ 10	BCC	TEM grid	Crystallography study with <i>in-situ</i> heating	2003
304	Nd–Fe–B	10 – 25	Core-shell	TEM grid	Segregation phenomena in Nd–Fe–B NCs	2015
305	Ni	3 – 10		Si	Size-dependent magnetic properties	2010
306	Ni	2 – 12		Si	Memristor application	2013
307	Ni, Pt, Au	2 – 10	Crystalline	Au-Si	Memristor application	2014

308	Ni@CoO	~ 11	Core-shell, fcc Ni tetrahedral	Si, TEM grid	Exchange coupling between the ferromagnetic Ni core and the antiferromagnetic CoO shell	2017
309	Ni@Cu	18 – 24	Polycrystalline core	TEM grid, Si	Analytical model describing the deposition of Cu shell on top of existing Ni core	2014
310	Ni@Ti	4 – 30	Core-shell	Si, TEM grid	In-flight Ti shell deposition onto the Ni core	2017
311	Ni-Co-Cr	3 – 6		glass	Multicore-shell structures and magnetic properties	2021
312	Ni-Cr	4 – 7	Core-satellite	Si	Magnetic NCs	2017
313	NiFeO _x H _y	3.9 – 8.4	Polycrystalline with defects	TEM grid, Au sheet	High performance OER	2018
314	Ni@NiO	~ 12	Crystalline	Si, TEM grid	The effect of NiO shell thickness on magnetic exchange bias field.	2015
315	Ni/NiO	5 – 25	Crystalline	TEM grid	Dual-phase NCs with hollow cathode sputtering	2019
316	Ni/NiO	~ 30	Dual phase crystalline	Si-Ti, TEM grid	Impact of nanoparticle magnetization on 3D structure formation	2019
317	Ni/NiO	8 – 15	Single crystal tetrahedral	Si, TEM grid	Controlled growth of NC structure, morphology and tuning of magnetic properties	2014
318	Ni/NiO	3 – 8	Core-shell crystalline	HOPG, TEM grid	Detailed investigation of the structure in Ni/NiO core-shell NCs	2012
319	Ni/NiO	4 – 8	Single crystal tetrahedra	HOPG, TEM grid	<i>In-situ</i> XPS study of different oxidation stages	2011
320	Ni/NiO/CoO	8 – 15	Core-shell crystalline	TEM grid	Steering the magnetic properties by core-shell interface and interparticle interactions	2017
321	Ni ₅ Cr	~ 20	Core-shell	Si, TEM grid	Structural, physical, and magnetic property alterations of NCs induced by heat treatment	2017
322	NiCr	~5	Crystalline	Si, TEM grid	Surface segregation and its effect on their magnetic behavior	2015
323	NiO		Crystalline	3C-SiC	OER	2019
324	NiPt	15 – 25	Crystalline alloy	TEM grid, carbon cloth	NC produced by hollow cathode plasma and HER application	2021
325	Pb	50 – 130		TEM grid, carbon	Melting and evaporation of Pb NCs on the CNW were retarded by the confined thermal transportation along	2010

				nanowire (CNW)	the CNW.	
326	PbO-Pb			TEM grid, quartz	Thermal stability of the PbO-coated Pb	2006
327	Pd	2 – 10		TEM grid	Mathematical study of Pd NC distribution	2010
328	Pd	50 – 250 atoms		Graphene oxide film	NC-size-dependent immobilizing energy on graphite	2006
329	Pd	3.5 - 6		IDE	Hydrogen sensor based on tunneling between Pd clusters	2007
330	Pd	6 – 12		TEM grid	Fine tuning NC growth	2011
331	Pd	~ 5	Crystalline	TEM grid	Coalescence-induced crystallisation	2015
332	Pd	>10000 atoms		Graphene	Enhanced quantum coherence in graphene	2015
333	Pd	~ 8	Crystalline	IDE	H ₂ sensor application	2012
334	Pd	~ 9		TEM grid, glass carbon electrode	Nonenzymatic hydrogen peroxide detection	2015
335	Pd	~ 9	FCC	Graphene, TEM grid	High-performance methanol electro-oxidation	2020
336	Pd	~6.7	FCC	Graphene, TEM grid	Methanol electro-oxidation	2017
337	Pd	~8	Crystalline	IDE, TEM grid, polyimide (PI)	H ₂ sensing on a flexible substrate	2023
338	Pd	~8.5		IDE, TEM grid	H ₂ sensor	2011
339	Pd	~8	FCC	TEM grid, quartz	Investigation of Pd NCs in optical nonlinearity and ultrafast dynamics	2016
340	Pd	1.6 – 2.6		TEM grid	Size-selected Pd NCs as mass standard to study industrial particle size and shape	2013
341	Pd	2 – 10		Al ₂ O ₃ , TiO ₂	Selective hydrogenation of 1-pentyne to 1-pentene	2018
342	Pd	2.5 – 7.5	Polyhedron nanocrystalline	IDE, TEM grid	Conductance-based strain sensor	2020
343	Pd	4.7	Single crystalline	Ni ₃ Al(111),	Size-dependent adsorption energy of CO molecules on Pd	2013

				TEM grid	NCs	
344	Pd	6.1 – 8.6		IDE, Si, TEM grid	H ₂ sensor	2013
345	Pd	6.5 – 12	Crystalline	Graphene, TEM grid	Detection of hydrogen peroxide	2016
346	Pd	8	Crystalline	TEM grid, quartz	Investigation of the contact between the Pd NCs and quartz	2016
347	Pd	10	FCC	IDE, TEM grid	Response characteristics of H ₂ sensor application with PMMA-membrane coated NC film	2017
348	Pd	10,20,55,120 atoms		Graphene oxide film	Catalytic oxidation of cyclohexane	2013
349	Pd	13 nm with polymer		IDE	Metal organic framework (MOF) polymer (ZIF-67/PMMA) on Pd NC film to enhance H ₂ detection sensitivity	2022
350	Pd	55- 400 atoms	Crystalline	Graphite tape, TEM grid	1-pentyne hydrogenation reaction	2012
351	Pd				Size-dependent morphology	2015
347	Pd	10	Crystalline	Si with Au electrodes	H ₂ sensor application	2017
352	Pd	5	Crystalline	MgO	H ₂ storage application	2018
353	Pd	7.9 – 8.2		PET	Strain-sensor (1000 G.F.)	2018
354	Pd	7.5		PET + Ag IDE	Flexible H ₂ gas sensor	2018
355	Pd	3, 5	Single crystalline	Mg/MgO	OER	2019
356	Pd	5	Bulk Pd FCC	PET	H ₂ detector	2019
357	Pd	16		PET	Pressure sensor/Barometer	2019
358	Pd, SnO ₂	6, 4.5	FCC	IDE	H ₂ gas sensor	2014
359	Pd/In ₂ O ₃	4.6	Crystalline	IDE, TEM grid	Ethanol vapor sensing	2024
360	Pd/SnO ₂		Crystalline	IDE, TEM grid	H ₂ sensor	2024
361	Pd ₅₅ ⁺ , Pd ₃₀₉ ⁺			Graphene oxide film	Realistic reaction conditions for methane oxidation	2011
362	Pd ₁₀₀ -	6.2 – 7.8	Crystalline	IDE, Si, TEM	Effects of Ni content in Ni-doped Pd NCs on hydrogen	2016

	$x\text{Ni}_x$ ($0 \leq x \leq 60$)			grid	sensing response	
363	PdCu	4 – 12	FCC	Glass, Si, TEM grid, glassy carbon	Highly efficient electrocatalysts for formic acid oxidation	2022
364	PdCu	6.7 ± 1.1		IDE, TEM grid	Charge transport in percolating network	2014
365	PdO	~ 16.7	Crystalline	TiO ₂	NC enhanced photocatalytic and self-cleaning properties	2020
366	plasma polymerization of acrylic acid	40 ± 15		Si	Nanophase-separated poly(acrylic acid)/poly(ethylene oxide) plasma polymer NCs for the spatially localized attachment of biomolecules	2019
367	Pd/Ti	~ 5		Alumina powder	(1-pentyne) selective hydrogenation	2016
368	Pt	4.5	Crystalline	Si	Strain-sensor (75 G.F.)	2012
369	Pt	2 – 12		Si with Au electrodes	Gas sensors	2012
370	Pt	4 – 6		Si with Au electrodes	DNA biosensor	2016
371	Pt	5		Si with Au electrodes	Lead (Pb ²⁺) detection	2017
372	Pt	1		STO	Electrochemical HER	2018
373	Pt	2 – 4		Si	Strain-sensor (45 G.F.)	2018
374	Pt	4 – 6		Si with Au electrodes	Acetamiprid and atrazine detection	2018
375	Pt	3		Si with Au electrodes	Pesticide detection	2018
376	Pt	1 – 5	Single crystalline	SnO ₂ , Si, TEM grid	CO sensing	2020
377	Pt	4.5		Au/Ti IDEs on Polyimide substrate	Strain-sensor	2020
378	Pt	5		Si with Au electrodes	Chloract 48 EC (a chlorpyrifos based insecticide) and Relative Humidity (R.H.) sensing	2020

379	Pt	3900 – 20000 atoms	Single crystalline	TEM grid	NC tuning for size and shape control	2021
380	Pt	1 – 5		Marimo carbon	Fuel-cell catalysis	2021
381	Pt	~ 5	Single crystalline	TEM grid	Atomic surface diffusion	2014
382	Pt	2 – 16		SiO ₂	Self-sustained CO oscillations observed on Pt NCs	2013
383	Pt	2 – 11	Single crystalline	Glassy carbon	Effect of NC size on oxygen electroreduction activity	2012
384	Pt	2 – 7	Crystalline	Al ₂ O ₃	Size-dependent NC morphology	2012
385	Pt	2 – 10	Single crystalline	TEM grid	Direct observation of oxygen-induced Pt NC ripening	2010
386	Pt			IDE	Gas sensing	2021
387	Pt	4 – 5		TEM grid, poly(2-hydroxyethyl methacrylate)	Flexible polyimide chemical sensors	2013
388	Pt	2.1	Crystalline	CeO ₂ (111) and (100)	NC morphology supported on different substrates	2023
389	Pt	55 – 309 atoms	Crystalline	TEM grid	Size-dependent morphology (lattice structure), with MD simulation	2019
390	Pt ₄ ⁻			graphite	Energetic implantation of size-selected metal cluster ions below the surface of graphite	2003
391	PtCu	1 – 6	Single crystalline	Al ₂ O ₃	Experiment and density functional theory (DFT) study of PtCu NCs catalysis on acetylene semihydrogenation	2020
392	PtCu	4 – 6	Crystalline	GC, Si, TEM grid	Electrocatalytic HER	2020
393	Pt-TiO ₂	2 – 5	Multi core-shell	Glassy carbon electrode, TEM grid	Size-dependent multi-core (55000 Daltons) NCs	2015
394	Pt _x Y	4 – 9	Poly-crystalline	Glassy carbon	High OER performance	2014

				substrate		
395	Polytetrafluoroethylene	~ 30		Al foil, Au-Si, Glass, Si	Super-hydrophobic properties	2012
396	PtPd	3.8 – 14.1	FCC	TEM grid	Dependence of growth shape of PtPd alloy nanocrystals on their composition.	2021
397	PtRu	4.5	Poly-crystalline	TEM grid, glassy carbon	Electrochemical reduction of oxygen	2015
398	Pt _x Gd	3, 5, 7, 9			Enhanced activity for oxygen electroreduction	2015
399	PtY	9	Poly-crystalline	TEM grid, glassy carbon	Direct observation of the dealloying process in bimetallic NCs	2015
400	Ru	~ 5	Crystalline	RuO ₂	Surface oxidation states for OER by synchrotron radiation measurements	2017
401	Ru	2 – 10	Crystalline	TEM grid, glassy carbon	Effect of thermal oxidation and oxygen plasma treatment in OER application	2016
402	Ru	4 – 10	Crystalline	SiO ₂	Reduction of turn over frequency (TOF) for size-selected Ru NCs with repeated methanation reaction	2013
403	Ru	3 – 15	Crystalline	HOPG	Probing the active sites for CO dissociation	2012
404	Ru	2 – 15	Single crystalline	HOPG	Probing the crossover in CO desorption	2011
405	Ru	2 – 15	Single crystalline	HOPG, TEM grid	Morphological study	2009
406	Ru	2 – 15		HOPG	Comparison between gas-phase condensation and thermal evaporation source for Ru NC synthesis	2009
407	Ru	2.8	Icosahedral and HCP	CuO NW	Transformation of Ru to RuO _x during biased interfacial charge transfer	2019
408	Ru/RuO ₂	4 – 6	Poly-crystalline	HOPG	OER	2015
409	Si	80	Crystalline	Glass, TEM grid	Formation and photoluminescence of “cauliflower” Si NCs	2015
410	Si	4 – 1000 atoms			Ultraviolet photoelectron spectroscopy of Si ₄ ⁺ to Si ₁₀₀₀ ⁺	2001
411	Si-Ag			Si	Ag shell coating	2013
412	Sm-Co	2 – 20		Carbon cloth	OER	2023

413	Sm– (Co _{0.7} X _{0.3}) _{4.5} (X = Ni, Cu)	~ 10	Crystalline	Si, TEM grid	Magnetic property improvement and crystallization tuning	2019
414	SmCo	7 – 25	Single crystal	Si, TEM grid	Post-annealing for NC crystallization and C coating as protection layer for NCs	2017
415	SmCo ₅	~ 2.5	Single crystalline	Si, TEM grid	Effect of exchange interactions on the coercivity in NCs	2013
416	Sn	2 – 15		TEM grid	Control of oriented gradient in size and number density on substrates	2007
417	Sn	2.3 – 3		Si, TEM grid	Early morphological evolution of NCs	2005
418	Ta	5 – 10	Crystalline core with amorphous shell	TEM grid, glassy carbon	Reactive sputtering and oxygen reduction reaction (ORR) for catalysis application	2016
419	Ta	~ 3.8	Amorphous	Si, TEM grid	Design and assembly of nanoporous Ta NC films with a gradient oxidation profile	2013
420	Ta	3	Single crystalline	Embedded a-Si on Cu foam	Li-ion battery	2017
421	Ta	3	Single crystalline	Si amorphous film	Li-ion battery	2021
422	TaO _x + Pt	4 – 5	Amorphous Ta, crystalline Pt	Si	OER	2017
423	Ta@Si ₁₆ ⁺			HOPG	Extended X-ray absorption fine structure (EXAFS) measurements	2024
424	Ta@Si ₁₆			C ₆₀ , Si	Chemical reactivity of NCs to reactive NO gas	2018
425	Ta@Si ₁₆	0.2 – 1.6		HOPG	Immobilization of cation NCs of Ta-atom-encapsulated Si ₁₆ cage onto C ₆₀ by donor-accepter interaction	2014
426	Ta ₃ NyO _x	14 ± 3	Tunable crystallinity	Si, TEM grid, quartz	Structure, crystallinity, chemical, and optoelectronic properties controlled by NC design, and OER	2021
427	TaSi ₁₆	~ 1		HOPG	Chemical characterization of an alkali-like superatom consisting of a Ta-encapsulating Si ₁₆ cage	2015
428	Tb-Fe	30		Si	Ferromagnetic properties	2007
429	Tb-Fe	31 – 35		Si	Size-dependent magnetostrictive properties	2010
430	Ti	4 mm for		Glass, Si-Ti	Mechanical stability probed by AFM	2013

		titanium clusters, 1.5 mm for polymeric clusters				
431	Ti	3 – 10		TEM grid	Mathematical study of NC formation during the NC nucleation and growth	2013
432	Ti	20, 40, 70	Crystalline	α -Si thin film	Improving optical absorption in α -Si thin film with TiO ₂ Mie scatterers	2017
433	Ti	10 – 20	Single crystalline	Si, TEM grid	Annealing and morphological study	2011
434	Ti	15 – 30		Si	Control of wettability of plasma polymers on substrates by application of Ti NCs	2011
435	Ti-doped ZnO	~ 10	Single crystalline	Si	Ferromagnetism	2006
436	TiN, Ti _x Al _{1-x} N	~ 3		Si	Hard impact onto substrate	1998
437	Ti, Co				Influence of reactive gases on the formation of NCs	2012
438	Ti-Cu	5 – 10 (8)		Si	Modeling of bimetallic alloy NC growth	2018
439	TiO ₂	4 – 8	Amorphous till 8 nm	Si	OER of size-selected NCs	2014
440	TiO _x	10 – 30		Si	Role of oxygen admixture in stabilizing TiO _x nanoparticle deposition	2013
441	TiO	~ 5		Si	Memristor application	2013
442	TiO/TiO ₂	15 – 40	Various crystalline	TEM grid	Structure dependent magnetization	2009
443	TiO ₂	14.4	Rutile TiO ₂ – VDFO	Si, TEM grid	In-flight coating of NCs with uniform vinylidene fluoride oligomer (VDFO) molecules and dielectric property characterization	2011
444	TiO ₂	~ 8.5		Hemispheri-	Porous TiO ₂ nanoparticle coatings on the surface of GaN	2014

				cal glass prisms, p-GaN layer, silica	LEDs for light output enhancement	
445	TiO ₂	3.14 – 6.5		Bismuth vanadate BiVO ₄	Size-dependent OER properties	2017
446	TiO ₂	16.5		Si	A small amount of O ₂ in the working gas mixture is found to significantly affect the discharge voltage and the formation of initial clusters	2023
447	V Pt/Ti Ti V/Ti Mo V Pt/V	4 8 7 5 5 8 7		TEM grid, glassy carbon substate	Control of size, composition and morphology for various NCs	2015
448	W@Si ₁₆			HOPG	Characterization of Group VI metal encapsulated by a Si ₁₆ cage on organic substrates	2024
449	W/WO ₃	3 – 5.5		Si	O ₂ introduction to aggregation chamber to induce production of oxide clusters	2015
450	Y/Co	8 – 10			Magnetic properties	2011
451	Y-Co	< 10	Crystalline	Si	Magnetic properties of YCo ₂ , YCo ₃ , and YCo ₅ NCs	2011
452	Y ₂ O ₃	3 – 20	Crystalline	TEM grid, TiO ₂	Introduction of artificial pinning sites by Y ₂ O ₃ NCs in YBa ₂ Cu ₃ O _{7-δ} thin films	2007
453	ZnO	~ 7	Crystalline	Si, TEM grid	A blueshift of 125 meV in NC relative to the PL (3.3eV) of a single crystal	2005
454	ZnO	~ 8	Crystalline	ITO, TEM grid	Cathodoluminescence	2007
455	ZnO	~ 7		SiC, TEM grid	Enhancement of light extraction efficiency of the flip-chip-LEDs by ZnO NCs	2015

456	ZrO ₂	3 – 9		Si, TEM grid	Size-dependent ferromagnetism	2020
457	Hf _x Zr _{1-x} O ₂	4 – 14	Various Crystalline	Si, TEM grid	Size and composition dependent structure and morphology	2024

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