

Index

a

- Ag–CoFe₂O₄ dimers 314
- Ag-containing single or double shell core-shell metal nanoparticles 218
- Ag nanocluster-based phase-transfer assisted method 195
- Ag–Pt–Fe₃O₄ 330, 332
- Ag₂S–Ag, Au, and hollow Pt nanoparticles 228
- Ag₂S–Ag core-shell nanostructures 108
- Ag₂S–Ag dimeric nanocomposites 150–152
- Ag₂S–Ag nanocomposites 150, 152–155, 241
- Ag₂S–hPt hetero-dimers 229
- Ag₂S–Ir nanonets 198
- Ag₂S nanocrystals 222
 - coalescence-fracture-ripening growth mechanism 111, 115
 - diffusion of gold 384–391
 - dimeric synthesis 116
 - growth mechanism of 113–115
- LaMer nucleation-growth model 111
 - quasi-spherical particles 111
 - structural evolutions of 112–113
 - toluene at room temperature 111
- Ag₂S nanoparticles 384
- Ag₂S–noble metal composite nanosystems 217
- Ag₂S–Pt nanocomposites 278–281
- alkanethiol 11, 38, 42, 54

- alkylamine stabilized metal nanoparticles 53, 54
- alloy precursors 110, 239, 319, 349
- amine-stabilized nanoparticles 39
- ammonium dibutyl phosphate ([AD]PO₄) 235
- as-prepared Au–Ag₂S–Pt nanocomposites 282
- as-prepared carbon-supported Ag₂S nanocrystals 408
- as-prepared hM-RuNPs 344
- as-synthesized noble metal-based nanocomposites 420
- Au₂–Au₁–Fe₃O₄ nanocomposites 315, 316
- Au–CdSe–Au nanodumbbells 184
- Au dendrimer-encapsulated nanoparticles (Au DENs) 41, 42
- [Au(en)₂]³ complex 304
- Au–Fe nanodimers 319
- Au₁–Fe₃O₄ nanocomposites 315
- Au₁–Fe₃O₄ peanut-like nanoparticles 327
- Au–Ge–Fe₃O₄ heterotrimers 333
- AuMn alloy nanoparticles 317
- Au nanoparticles 36, 39, 46
- Au organosol 388
- Au/PbSe molar ratio 403
- Au_{0.80}Pd_{0.20}–Fe_xO_y nanocomposites 326
- Au/TiO₂ catalysts 304
- Au-tipped CdSe/CdS nanorods 87, 88

b

- Banin group 4, 5, 72–81, 162
 bimegnetic composite nanocrystals 323
 bimetallic Au–Pt cage-bell structures 226
 bimetallic Cu–Pd nanoalloys with different Pd/Cu molar ratios 360
 bimetallic heterostructures 3
 bimetallic/trimetallic M–Ru nanoparticles with hollow interiors (hM–RuNPs) 343, 344
 binary Ag₂S 152
 binary Ag₂S-noble metal nanocomposites 196
 Bi₂S₃–Au nanocomposites 94
 bis(*p*-sulfonatophenyl)phenylphosphane (BSPP) 2, 220, 281, 285
 Brust–Schiffrin method 81
 amine-stabilized nanoparticles 39
 ethanol-mediated transfer of metal ions 48–52
 extension of 40
 functionalized nanomaterials 38
 isocyanide-protected Pt nanoparticles 39
 MPC core size 39
 stabilizing ligands 41
 thiol-stabilization 38
 bulk semiconductors 383
 burst nucleation 6

c

- cage-bell structured Pt–Ru nanoparticles 283–286
 calcination 2, 304, 305, 308, 310, 348, 349, 361, 364–368
 calcination of bimetallic Cu–Pd nanoalloys supported on γ-Al₂O₃ substrates 361–364
 capping agents 7, 8, 11, 12, 38, 53, 56, 77, 252
 carbon-supported Ag₂S–Pt nanocomposites 409, 414
 carbon-supported hM–RuNPs 348
 4-carboxythiophenol (4-CTP) 46
 catalytic activities of γ-Al₂O₃-supported Cu–Pd nanoalloys 366–368
 catalytic multicomponent reactions 135
 catecholamines 321
 (C)/(CNT)-supported hollow structured nanocomposite 343
 CdS–Au composite nanosystem 122
 CdS–Au hybrids 395
 CdS core-shell nanorods 109
 CdSe–Ag hydrosols 157
 CdSe core-shell nanocomposites 110
 CdSe core-shell nanostructures 103
 CdSe nanoplatelets 175
 CdSe nanorods 76
 CdSe/Pt molar ratio 268
 CdSe–Pt nanocomposites
 core-shell structured 258
 electrostatic interactions 257–258
 ethanol-mediated phase transfer protocol 251
 general phase transfer protocol 251
 ligand exchange based phase transfer 251–256
 non-polar environments 250
 polar solvents 250
 thermosensitive ligand 251
 CdSe-seeded CdS nanorods 180
 CdS nanocrystals 71
 CdS–Pd₄S nanocomposites 173
 cetyltrimethyl ammonium bromide (CTAB) 1, 56, 102, 105, 195
 chalcogenide semiconductor-gold nanocomposites
 Banin group contributions 72–81
 Brust–Schiffrin method 83
 case study
 Bi₂S₃–Au 94
 Cu₂S–Au 93–94
 Cu₂ZnSnS₄ (CZTS) 97
 PbTe–Au 91–93
 photogenerated electron and hole separation 100–101
 SnS–Au 94–96
 ZnSe–Au 96–97
 Chan group 86, 87
 DDA or light reduces 70

- electrostatic/direct self-assembling process 72
 growth of 102–110
 Lee group 81
 localized surface plasmon resonance (LSPR) 83, 84
 metal selenide (Se) nanocrystals 70–72
 non-polar organic solvent seed-mediated growth 70
 primary objectives of 70
 propargylic amines a three-component coupling reaction 70
 solution-based self-assembly 88
 three-component coupling 135
 two-phase strategy 132
 chalcogenide semiconductors 319
 dual metal nanoparticles 176–185
 nanocrystals 251
 platinum (Pt) nanocomposites 158
 silver (Ag) 150
 chemical vapor deposition (CVD) techniques 8
 chromoamperometric (CA) tests 413
cis-dimethyl(*N,N,N',N'*-tetramethyl-enediamine)palladium(II) (*TMEDAPdMe*₂) 165
 citrate-stabilized gold nanoparticles 308
 classical nucleation theory 8, 9
 coalescence-fracture-ripening growth mechanism 111, 114, 115
 coalescence of Ag₂S and Au nanocrystals at room temperature
 extraction of Au from Au-containing alloy nanoparticles 397
 mechanism responsible for 393
 observation of 391
 removal of Au from quantum dot-Au hybrids 395
 CODPtMe₂ 165
 CoFe₂O₄ monomers 314
 CoFe₂O₄ nanoparticles 313
 colloidal nanorods 5
 colloidal single-material nanoparticles 8
 colloidal synthesis 310
 metal selenide nanocrystals 70
 comb stabilizer 37
 commercial RuO₂ 357
 complicated semiconductor-noble metal nanocomposites 384
 composite Au–MnO nanoparticles 317
 composite nanomaterials 327
 characterizations of 11
 emergence of 3
 wet-chemistry synthesis of 6
 composite nanosystems 420
 conventional hybrid nanomaterials 3
 copper indium disulfide (CuInS₂) 166
 copper(I) sulfide (Cu₂S) nanocrystals 172
 core-shell Ag–Ag/Pd nanoparticles 235
 core-shell Ag–noble metal nanoparticles 222
 core-shell Ag–Pt nanoparticles 218
 core-shell alloy 3
 core-shell CdSe–CdZnS nanocrystals 253
 core-shell CdSe–CdZnS organosol 253
 core-shell CdSe–CdZnS semiconductor nanocrystals 256
 core-shell CdSe–Pt composite systems 412
 core-shell nanoparticles 3
 core-shell nanostructures 308
 core-shell-shell Au–Ag₂S–Pt nanocomposites 281
 core-shell silver (Ag)-noble metals 2
 core-shell structured CdSe–Pt nanocomposites
 compressive strain effect 262
 EDX analysis 261
 electrochemical activity 264–269
 high-angle annular dark-field scanning TEM 261
 HRTEM images 259
 TEM images 259

- core shell structured
 semiconductor-noble metal nanocomposites 270
- CO stripping voltammograms 230
- Coulomb interaction-mediated electron-hole dynamics 169
- CuInSe₂ core-shell nanocomposites 110
- CuInS₂ nanocrystals 167
- CuO-Pd nanocomposites 358–360
- Cu₂S-Au nanocomposites 93
- Cu₂ZnSnS₄ (CZTS)
 nanocomposites 97
 nanocrystals 105
- d**
- defect growth 76
- densely packed optically active porphyrins 217
- dented Fe₃O₄ nanoparticles 316
- deposition-precipitation method 304, 310–312, 358
- didodecyldimethylammonium bromide (DDAB) 73, 110, 183
- diffusion phenomenon 218, 242, 386, 413
- diisopropylethylamine (DIPEA) 158
- dimeric Ag-Fe₃O₄ nanocomposites 322
- dimeric Ag₂S-Au products 393
- direct formic acid fuel cell (DFAFC) 209, 232, 421
- direct methanol fuel cells (DMFCs) 209, 250, 264
- Ag₂S-Pt nanocomposites 278–281
- cage-bell structured Pt-Ru nanoparticles 284
- commercialization of 277
- core-shell-shell Au-Ag₂S-Pt nanocomposites 281
- electrocatalysts 277
- membraneless 289
- Nafion membrane 277
- Pd nanoparticles 286–288
- proton exchange membrane 277
- selective electrocatalyst-based 289–294
- distribution ratio (DR) 50
- disulfide modified biotin 74
- dodecanethiol 38, 39, 53–56, 98, 102, 105, 194, 238, 239
- dodecylamine (DDA) 15, 36, 49, 69, 73, 110, 183, 210, 228, 335, 391, 403
- dodecyldimethylammonium bromide (DDAB) 73, 110
- DP urea method 304
- dual metal nanocomposites
 Au-Fe_xO_y tip on CdSe seeded CdS nanorods 176
- chemoselective growth behavior 178
- dodecylamine (DDA) 183
- light induced deposition of 176
- in photocatalytic hydrogen generation 179
- photocatalytic hydrogen production 182
- physical and chemical characteristics 176
- dumbbell-like Ag-CoFe₂O₄ nanocomposites 313
- dumbbell-like Au-Fe₃O₄ nanocomposites 312
- dumbbell-like Au-MnO nanocomposites 326
- dumbbell-like metal oxide-noble metal nanocomposites
 Ag-CoFe₂O₄ dimers 314
 Au-Fe nanodimers 319
 Au₁-Fe₃O₄ nanocomposites 315
- AuMn alloy nanoparticles 317
- Au_{0.80}Pd_{0.20}-Fe_xO_y dumbbell-like nanocomposites 326
- bimagnetic composite nanocrystals 323
- catecholamines 321
- chalcogenide semiconductors 319
- CoFe₂O₄ monomers 314
- CoFe₂O₄ nanoparticles 313

composite Au–MnO nanoparticles 317
 dented Fe_3O_4 nanoparticles 316
 dimeric Ag– Fe_3O_4 nanocomposites 322
 dumbbell-like Au–MnO nanocomposites 326
 epidermal growth factor receptor antibody 314
 epitaxial materials 325
 $\text{FePt}-\text{Fe}_3\text{O}_4$ dimeric nanocomposites 323
 heterogeneous seeded-growth process 326
 hydrophobic Ag– Fe_3O_4 heterodimer nanocomposite 323
 indium-doped cadmium oxide 326
 Kirkendall process 319
 magneto-optical characterization 313
 manganese acetylacetone ($\text{Mn}(\text{acac})_2$) 317
 metal-ICO dumbbells 326
 monodisperse dumbbell-like $\text{Pt}-\text{Fe}_3\text{O}_4$ nanocomposites 320
 monodisperse metal-doped plasmonic oxide 326
 NdFeB permanent magnet 323
 noble metal nanocrystal-based two-photon fluorescence indicator 323
 optically active plasmonic (Au) unit 314
 oxide-based heterogeneous nanocomposites 320
 $\text{PdS}_x-\text{Co}_9\text{S}_8$ and $\text{Cu}_2\text{S}-\text{In}_2\text{S}_3$ heterodimers 323
 polycrystalline Fe_3O_4 domains 320
 synthesis and application of 312
 target-specific platin delivery 314
 ternary structured nanocomposites 315
 ultrasonic emulsification 322
 wet-chemistry based approaches 312

e

electrochemically active surface areas (ECSAs) 202, 203, 230, 265, 282, 412
 electron density 12, 15, 120, 123, 149, 201, 217, 223, 230, 235, 238, 278, 331, 403, 408
 electronic coupling effect 2, 11, 16, 17, 194, 211, 235, 277, 286, 295, 413
 electron paramagnetic resonance (EPR) 79
 electron-transfer phenomena 331
 electrostatic interactions 41, 45–47, 49, 56, 89, 105, 252, 257, 271, 420
 energy conversion and storage 420–421
 energy dispersive X-ray spectroscopy (EDX) 12, 13, 90, 193, 196, 223, 324
 ensemble effect 249
 epidermal growth factor receptor antibody (EGFRA) 314
 epitaxial materials 324, 325
 ethanol-mediated phase transfer 35–60, 70, 110–132, 251, 419
 $\text{Ag}_2\text{S}-\text{Au}$ 111
 dodecylamine (DDA) 110
 $\text{HgS}-\text{Au}$ 119
 of metal ions 48–52
 of metal nanoparticles 53–57
 metal sulfide nanocrystals
 Au deposition of 125
 CdS–Au composite nanosystem 122–125
 in oleylamine 122
 PbS–Ag/Au nanocomposites 127–132
 exciton-plasmon coupling 94
 extraction of Au from Au-containing alloy nanoparticles 397–401

f

facet-preferential ligand adhesion 8
 Faraday rotation 313, 314
 $\text{FePt}-\text{Fe}_3\text{O}_4$ dimeric nanocomposites 323

- Fermi level 4, 131, 173, 206, 263, 301, 393, 395, 398
 fine Ag_2S –Pt nanocomposites
 supported on carbon substrates
 for methanol oxidation reaction
 408–413
 finite-difference time-domain (FDTD)
 simulations 154
 formic acid oxidation reaction (FAOR)
 194, 209–211, 232
 Fourier-transform infrared (FT-IR)
 spectroscopy 11, 254
- g**
 Gibbs free energy balance 10
 glutathione tetramethylammonium salt
 (GTMA) 252, 256
 glycidyl methacrylate 37
 gold-based nanocomposites 302–303
 gold nanoparticle-decorated silicon
 nanowires 133
 gold precursors (HAuCl_4) 69, 74, 76,
 77, 81, 86, 98, 110, 111, 123, 228,
 304
 gold-sulfur bonding interactions 88
 GTMA-coated semiconductor
 nanocrystals 253
 GTMA–PbS hydrosol 256
 GTMA-stabilized semiconductor
 nanocrystals 254, 257
- h**
 heterodimer nanoparticle 229, 323
 heterogeneous catalysts 135
 heterogeneously structured
 semiconductor-insulator-metal
 nanowires 329
 heterogeneous nanocomposites 17, 18,
 84, 94, 95, 98, 103, 119, 120, 123,
 164, 168, 224, 232, 235, 240, 269,
 320, 419
 heterogeneous noble metal-based
 nanocomposites 241
 heterogeneous seeded-growth process
 326
 heterogeneous trimeric Fe_3O_4 –Pt–Ag
 nanocomposites 13, 14
- hexadecyltrimethylammonium bromide
 CTAB 257
 HgS–Au nanocrystals 119
 high angle annular dark-field detector
 (HAADF) 393
 high-angle annular dark-field scanning
 transmission electron
 microscopy (HAADF-STEM)
 90, 95, 153, 196, 261, 344, 420
 highly active hydrophobic Se species
 235
 high-order nanocomposites
 Ag –Pt– Fe_3O_4 heterotrimers 332
 Au– Fe_3O_4 peanutlike nanoparticles
 327
 Au– Fe_3O_4 peanut-like particles 327
 Au–Ge– Fe_3O_4 heterotrimers 333
 electron density 331
 electron-transfer phenomena 331
 heterogeneously structured
 semiconductor-insulator-metal
 nanowires 329
 Pt– Fe_3O_4 heterodimers 332
 Rhodamine B 334
 semiconductor–insulator–metal
 core-shell nanostructures 329
 ternary Fe_3O_4 –CdS–Au
 nanocomposites 334
 ternary Ni–Au–ZnO composite
 system 333
 ZnO nanorods 329
 high-order triakontadipolar plasmon
 modes 154
 high quality semiconductor/metal oxide
 nanocrystals 419
 high-resolution transmission electron
 microscopy (HRTEM) 6, 13,
 75, 193, 324
 hMO_x –RuO₂ 357
 hMO_x –RuO₂/C and hMO_x –RuO₂/CNT
 electrode materials 348
 nanocomposites 349
 products 349
 hollow noble metal nanoparticles
 222–225
 hopcalite catalysts 302, 303
 hybrid nanosystem 217

hydrogen photoproduction 309
 hydrogen selenide gas 71
 hydrophobic Ag–Fe₃O₄ heterodimer nanocomposite 323

i

InAs–Au composite systems 80
 InAs nanocrystals 80, 81, 384
 indium-doped cadmium oxide (ICO) 326
 inductively coupled plasma atomic emission spectroscopy (ICP-AES) 12, 50, 408
 inside-out diffusion of Ag 3, 218–222, 226, 235
 iridium dioxide (IrO₂) nanoparticles 173
 isocyanide-protected Pt nanoparticles 39

k

Kirkendall effect 80, 150, 151, 177, 238, 384
 Kirkendall process 150, 319

l

LaMer nucleation-growth model 111
 lauric acid 41, 251
 layer-by-layer growth 9
 L-glutathione (GSH) 56, 78, 157, 195
 ligand effect 181, 249
 ligand exchange 41, 310
 based phase transfer 251–256
 light-driven hydrogen production 168
 line-scanning analysis 228, 229, 286
 lowest unoccupied molecular orbital (LUMO) 169, 171

m

magnetically and optically active dumbbell-like nanocomposites 314
 manganese acetylacetone (Mn(acac)₂) 317
 matchstick-like nanorods 334
 membrane electrode assembly (MEA) 292

membraneless direct methanol fuel cell (DMFC) 289, 408

mercaptosuccinic acid (MSA) 46, 48
 mercaptoundecanoic acid (MUA) 46, 76, 157, 171, 260

metal hydrosols 53, 60, 256

metal-ICO dumbbells 326

metal oxide-noble metal nanocomposites

aberration-corrected scanning

transmission electron microscopy 306

Au/TiO₂ catalysts 304

calcination 310

catalyst preparation 304

catalyst synthesis and

characterization 305

citrate-stabilized gold nanoparticles 308

colloidal synthesis 310

core-shell nanostructures 308

CuO–Pd nanocomposites 358–368

deposition-precipitation method 304

DP urea method 304

dumbbell-like 311–327

electrochemical properties of RuO₂/C and RuO₂-Au/C nanocomposites 339–342

gold-based nanocomposites 302–303

high-order nanocomposites 327–335

high-resolution electron energy loss spectroscopy 306

hollow structured MO_x–RuO₂ (M = Co, Cu, Fe, Ni, CuNi) nanocomposites 342–358

hydrogen photoproduction 309

influence of different noble metals 368–371

ligand-exchange approach 310

3-mercaptopropionic acid 310

metal/semiconductor photocatalysts 310

metal/semiconductor Schottky contact 310

- metal oxide-noble metal nanocomposites (*contd.*)
reaction kinetics measurements 306
RuO₂-Au/C nanocomposites 336–338
RuO₂/C nanocomposites 336
scanning tunneling microscopy/spectroscopy 306
thiol-based molecule 310
yolk-shell nanostructures 308
- metal selenide nanocrystals, phosphine-free synthesis of 70–72
- metal/semiconductor photocatalysts 310
- metal/semiconductor Schottky contact 310
- metal sulfide nanocrystals
Au deposition of 125
CdS–Au composite nanosystem 122
in oleylaime 122
PbS–Ag/Au nanocomposites 127
two-phase strategy 132
- metal telluride nanocrystals 72
- metastable onion-like architecture 10
- methanol 271
electrooxidation 399
MOR 16, 217, 264–269
- methanol-mediated method 256, 258
- methanol oxidation reaction (MOR)
16, 194, 217, 229, 264–269
- methyl methacrylate 37
- microemulsions 1
- molecular beam epitaxy (MBE) 8
- monodispersed nanoparticles 6
- monodisperse dumbbell-like Pt–Fe₃O₄ nanocomposites 320
- monodisperse metal-doped plasmonic oxide 326
- monometallic/bimetallic TMNPs 343
- multiple Ag₂S-noble metal nanocomposites 200–203
- nanocomposites consisting of Ag₂S
Au, and hollow Pt nanoparticles 228
bimetallic Au–Pt cage-bell structures 226–227
electrochemical properties 229–232
hollow noble metal nanoparticles 222–225
Pd-based composite nanomaterials 232
platinum nanoparticles 235–238
- nanocomposites consisting of CuS and platinum nanoparticles 238–240
- nanocrystal quantum dots (NQDs) 110
- nanometer scale 1–3, 12, 35, 42, 69, 150, 193, 301, 383, 384, 391, 398, 419
- nanomultipods 334, 387
- nanoparticle geometry 3
- nanopyramids 334
- nanoreservoirs 301
- NdFeB permanent magnet 323
- nickel (Ni) decorated CdS nanorods 172
- noble metal-based heterogeneous nanocomposites 18, 240
- noble metal nanocrystal-based two-photon fluorescence indicator 323
- noble metal nanoparticles 1, 2, 16, 36–37, 53, 149, 217, 218, 220, 222–227, 242, 250–258, 307, 310, 358
- noble nanocomposites 269–271
- non-aqueous synthesis 48
- non-polar organic solvents 11, 35, 43, 49, 58, 69, 83, 110, 111, 251, 336, 414, 419
- non-Pt electrocatalysts 277
- n-type lead sulfide (PbS) semiconductor 4

n

- NaBH₄ reduction-based method 72
Nafion membrane 209, 277
Nafion 117 membrane 291

o

- OA-stabilized CdSe-CdZnS semiconductor nanocrystals 253, 256, 257

- oil aerosols 6
 oleic acid (OA) 81, 90, 94, 102, 173, 252, 326, 332, 402
 oleylamine (OLA) 11, 39, 45, 72, 93, 98, 105, 121, 167, 173, 218, 220, 287, 315, 343, 360, 387, 388, 402
 oleylamine reduction of Cu(acac)₂ 360
 oleylamine-stabilized Au nanoparticles 90, 258
 optically active plasmonic (Au) unit 314
 organometallic metal precursors 71
 Ostwald ripening 75, 86, 88, 114, 115, 121, 124, 222, 390, 395, 405, 421
 oxidation of CO 302–306, 326
 oxide-based heterogeneous nanocomposites 320
 oxide-based nanocomposites 17, 301, 371
 oxygen reduction reaction (ORR) 1, 194, 203, 264, 280
 polarization curves 264
- p**
 palladium (Pd) 87, 165, 172, 173, 175, 232–235
 Pb-oleate complex 82, 102
 PbS–Ag/Au nanocomposites 127–132
 PbS–Au nanostar-nanoparticle heterodimers 85, 86
 PbSe–Au nanocomposites mechanism for the nucleation and growth of Au on the surface of 406–408 synthesis of 403–406 synthesis of PbSe seeds 402–403
 PbSe seeds 402–403
 PbS nanocrystals 81, 85, 86, 121, 127, 131, 132, 138, 197, 404
 PbTe nanocrystals 91, 92, 384
 Pd-based composite nanomaterials 232
 Pd–CuO/γ-Al₂O₃ samples 362
 Pd nanoparticles 54, 165, 166, 199, 217, 232, 233
 PdS_x–Co₉S₈ and Cu₂S–In₂S₃ heterodimers 323
 phase transfer of metal nanoparticles advantage of 57–60 Brust–Schiffrin method 38–41 early studies in 36–37 electrostatic interaction 45–47 ethanol-mediated phase transfer 48–57 ligand exchange 41–45 organic phase 36 organic to aqueous phase 47–48
 phase-transferred Ag nanoclusters 195
 phosphate buffered saline 314
 phosphine 41, 71, 251
 phosphine-free method 71
 phosphine-free Se precursor 16, 71
 photocatalytic cycle 78
 photo-oxidative instability 183
 pineapple-like nanocomposites 406
 platinum(II) acetylacetone (Pt(acac)₂) 2
 platinum (Pt) nanocomposites aqueous-based deposition of 158 Banin group 162 CdSe nanocrystal seeds 159 CdSe nanorods decorated 169 CdS nanorods 159, 163, 164 cold electron transfer 169 controllable and site selective deposition of 165 CuInS₂ decorated 167 deposition of 162 electronic wavefunction with 169 fluence-dependent luminescence 161 homogeneous nucleation of 158 LUMO 170 nanocomposites consisting of Ag₂S 235 nanocomposites consisting of CuS 238–240 photocatalytic hydrogen generation 167 photodeposition of 158 photoinduced reduction and nucleation 165

- platinum (Pt) nanocomposites (*contd.*)
- Pt-tipped CdS nanorods 168, 171
 - Pt-tipped semiconductor nanorods 160
 - quantum efficiencies (QEs) 171
 - shell and overgrowth of 167
 - size of 169
 - TMEDAPdMe₂ 165
 - transient absorption spectroscopy 169
 - trioctylphosphine/Pt(acac)₂ 167
 - polycrystalline Fe₃O₄ domains 320
 - polymer coatings, and polyethylenimine (PEI) 78
 - polymer electrolyte membrane (PEM) 269
 - poly(styrene sulfonic acid)sodium (PSS) polymer 105
 - polystyrenes (PSSH) 59
 - propargylamines 135, 138
 - proton exchange membrane 17, 277, 289, 295
 - pseudomorphic metal monolayers 249
 - Pt–Au heterodimers 179
 - Pt-based electrocatalyst 267, 277
 - Pt-containing Ag₂S-noble metal nanocomposites
 - ECSAs 202, 203
 - electrochemical energy application 202
 - formic acid oxidation reaction 209–211
 - methanol oxidation reaction 203–209
 - oxygen reduction reaction 203–209
 - tunable catalyst designs 194 - Pt–Fe₃O₄ heterodimers 330, 332
 - Pt nanocrystals 2, 40
 - Pt nanoparticles 1, 2, 17, 39, 40, 54, 159, 164, 166, 210, 217, 218, 401
- q**
- quantum dot-Au hybrids 391, 395–397, 414
 - quantum efficiencies (QEs) 171
- r**
- reducibility of γ-Al₂O₃-supported Cu–Pd nanoalloys after calcination 365–366
 - reversed Kirkendall effect 80, 384
 - Rhodamine B 89, 334
 - rod-like CdSe–Pt nanocomposites 162
 - room-temperature methanol oxidation reaction (MOR) 280
 - Ru(acac)₃ 284
 - Ru nanoparticles 53, 172, 183
 - RuO₂–Au/C nanocomposites 336–338
 - RuO₂/C nanocomposites 336, 339, 342, 371
- s**
- scanning tunneling spectroscopy (STM) 75, 306
 - scientific-related issues 421
 - seed-mediated growth 2, 6, 7, 13, 50, 69, 70, 86, 102, 193, 223, 238, 249, 251, 258, 281, 384, 386, 388, 419
 - selected area electron diffraction (SAED) pattern 12, 112, 403
 - semiconductor–insulator–metal core-shell nanostructures 329
 - semiconductor–metal nanocomposites 4, 18, 100, 101, 165, 167, 171, 210, 249
 - semiconductor–metal nanostructures 78
 - semiconductor–noble metal hybrids 238
 - semiconductor–noble metal
 - nanocomposites 16–19, 69, 77, 83, 132, 162, 193, 200, 217, 238, 270, 301, 384, 386, 390 - semiconductor/oxide catalysts 4
 - separation of nucleation and growth 6
 - Se-phosphine complex 71
 - silicon (Si) nanostructures 133
 - silver (Ag) nanocomposites
 - binary Ag₂S 152
 - catalytic reduction of 150
 - CdSe–Ag aerogels 157

- electrical and thermal conductivity 150
 formation of 152
 growth of 150
 L-glutathione (GSH) 157
 nanocubes 154
 nanometer scale 150
 plasmon absorption bands 150
 polysulfide 154
 sulfidation process 153
 sulfidation products 154, 155
 silver sulfide (Ag_2S) nanocrystals 150
 aqueous synthesis of 194–196
 binary 196
 electrocatalytic property of Pt
 formic acid oxidation reaction 209–211
 methanol oxidation reaction 203–209
 oxygen reduction reaction 203–209
 multi-component nanocomposites 200
 seed-mediated growth 193
 synthesis of 193
 single crystalline Ag nanoparticles 220
 single-particle scattering measurements 154
 SnS–Au nanocomposites 94, 95
 sodium sulfide (Na_2S) 17, 108, 150, 169, 194, 218, 222, 225
 solar-to-chemical energy conversion 101
 sol-gel processes 1
 solvent environment 15, 419–420
 spectroscopic assays, polarography 79
 strain effect 11, 12, 17, 181, 249, 250, 262, 266, 267, 271, 286, 343, 355, 421
 sulfur hydrosols 6
 sulfur/selenium precursors 218
 surface-enhanced Raman scattering (SERS) 60, 72
 surface-modified Au nanoparticles 46, 47
 surface plasmon resonance (SPR) 77, 83, 154, 224, 326, 334, 383
 surfactant-driven method 88
 Suzuki cross-coupling reactions 217, 327
 synthesized TiO_2 nanocrystals 369
- t**
- ternary $\text{Ag}_2\text{S}-\text{Au}-\text{hPt}$ nanocomposites 228–230, 232
 ternary $\text{Ag}_2\text{S}-\text{Au}-\text{Pt}$ composite nanocatalysts 278
 ternary $\text{Fe}_3\text{O}_4-\text{CdS}-\text{Au}$ nanocomposites 334
 ternary nanocomposites 227–232, 327, 334, 358, 390
 ternary $\text{Ni}-\text{Au}-\text{ZnO}$ composite system 333
 ternary structured nanocomposites 315
 tetrahydrofuran (THF) 41, 98
 tetramethylammonium decanoate (TMAD) 57, 257
 tetraoctylammonium 251
 tetraoctylammonium bromide (TOAB) 38, 46, 86, 110, 257
 tetraoctylammonium-stabilized Pt nanoparticles 39
 tetrapods 5, 73, 88
 thermogravimetric analysis (TGA) 12
 thermosensitive ligand 251
 thiobenzoates 102, 103
 thiol-based molecule 310
 thiol-derivatized Au nanoparticles 257
 thiol-stabilized metal nanoparticles 38, 54
 thiol-terminated polystyrene (PS-SH) 57
 three-component coupling reaction 16, 70, 135, 136, 138
 TiO_2-Au composite materials 304
 TiO_2 -noble metal systems 4
 transfer efficiency (TE) 50, 119, 251, 420

- transition metal nanoparticles (TMNPs) 39, 343
- transmission electron microscopy (TEM) 6, 12, 13, 39, 75, 86, 90, 95, 153, 193, 261, 306, 324, 362, 384
- trimetallic hM-RuNPs 343, 344, 348
- trimethylamine (TEA) 158
- trioctylphosphine (TOP) 38, 71, 82, 163, 167, 259
- trioctylphosphine/Pt(acac)₂ 167
- triphenylphosphine-3,^{3'},3"-trisulfonic acid trisodium salt (TPP) 46
- triple distilled water (TDW) 162
- tunable optical properties 4
- u**
- ultrasonication 322
- ultrasonic emulsification 322
- ultraviolet-visible (UV-vis) absorption spectroscopy 11
- v**
- volatile organic compounds (VOCs) 17, 43, 302
- voltammograms 202, 207, 230, 232, 266, 268, 281, 399, 400, 413
- Vulcan XC-72 carbon support 202, 229, 264, 281
- w**
- water-soluble metal nanoparticles 57
- water-toluene biphasic system 257
- wet-chemistry approaches 1
- wet-chemistry based synthesis 77
- wet-chemistry methods 4, 19, 35, 369, 419
- wet-chemistry synthesis 6–11
- wetting function 9
- x**
- XC-72 carbon supports 202, 264, 281, 336, 337
- X-ray diffraction (XRD) 11, 39, 81, 193, 324, 385
- X-ray photoelectron spectroscopy (XPS) 11, 39, 193, 230, 336, 420
- y**
- yolk-shell nanostructures 307–309
- z**
- ZnO nanorods 329, 330
- ZnO quantum dots (QDs) 44, 45
- ZnSe–Au nanocomposites 96
- ZnSe–CdS–Pt system 168
- ZnTe semiconductor 168