

CONTENTS

INTRODUCTION	9
CONVENTIONS AND ABBREVIATIONS	11
1. MODIFICATION OF METAL SURFACES WITH NANOSTRUCTURED METALS BY GALVANIC REPLACEMENT	13
1.1. Galvanic replacement on the surface of aluminum	15
1.2. Galvanic replacement on the surface of nickel.....	24
1.3. Galvanic replacement on the surface of copper	32
1.3.1. <i>Silver deposition</i>	32
1.3.2. <i>Gold deposition</i>	40
1.3.3. <i>Deposition of palladium and PdPt bimetal</i>	43
1.3.4. <i>Deposition of bismuth and nickel from ionic liquids</i>	43
1.4. Usage	45
1.4.1. <i>Chemical catalysis</i>	45
1.4.2. <i>Electrochemical catalysis</i>	47
1.4.3. <i>Photocatalysis</i>	54
1.4.4. <i>Sensorics</i>	55
References	57
2. DEPOSITION OF NANOMETALS ON THE SURFACE OF SEMICONDUCTORS	63
2.1. Features of galvanic replacement of metals on a silicon surface with obtaining fixed nanoparticles, nanostructured deposits, nanofilms	64
2.1.1. <i>Influence of HF in solutions and its content</i>	66
2.1.2. <i>Ion's concentration of precipitated metal in solutions</i>	68
2.1.3. <i>Influence of process duration of galvanic replacement</i>	71
2.1.4. <i>Effect of temperature</i>	77
2.1.5. <i>Effect of surface active substances</i>	79
2.1.6. <i>Effect of the silicon surface nature (type and orientation)</i>	81
2.2. Decoration of the silicon surface with silver nanostructures	87
2.3. Decoration of the silicon surface with gold nanostructures.....	98
2.3.1. <i>Deposition of gold nanoparticles</i>	101
2.3.2. <i>Deposition of gold nanodendrites</i>	104
2.3.3. <i>Deposition of gold films</i>	106
2.4. Decoration of the silicon surface with nanostructures of platinum metals	107
2.5. Decoration of the silicon surface with nanostructured precipitates of copper, nickel and tellurium	113
2.6. Decoration of the silicon surface with nanostructured binary metal precipitates	118
2.6.1. <i>Co-deposition of two metals</i>	121
2.6.2. <i>Staged deposition of two metals on a silicon surface</i>	122

2.6.3. Combined deposition methods of nanostructured bimetals.....	123
2.7. Decoration of porous silicon with nanostructured metals.....	125
2.8. Decoration of the silicon surface with metal nanostructures in a non-aqueous medium.....	135
2.8.1. Galvanic replacement from alcohol solutions.....	135
2.8.2. Galvanic replacement from solutions of organic aprotic solvents.....	136
2.8.3. Galvanic replacement in ionic liquids.....	140
2.9. Decoration of germanium surface with metal nanostructures.....	141
2.10. Decoration of A ^{III} B ^V surface with metal nanostructures.....	148
2.11. Usage of composites based on a semiconductor surface decorated with nanostructured metals.....	159
2.11.1. Metal activated etching of the surface of semiconductors.....	159
2.11.2. Usage in sensorics.....	162
2.11.3. Catalysis.....	165
References.....	167
3. SYNTHESIS OF NANOSTRUCTURES ON A SACRIFICE NANOTEMPLATE BY GALVANIC REPLACEMENT.....	182
3.1. Features of nanoscale galvanic replacement.....	182
3.2. Conditions for nanostructures formation by galvanic replacement in aqueous solutions.....	190
3.2.1. Synthesis of nanostructures based on AgNPs.....	197
3.2.2. Synthesis of nanostructures based on PdNPs.....	210
3.2.3. Synthesis of nanostructures based on CuNPs.....	213
3.2.4. Synthesis of nanostructures based on MgNPs, CoNPs, NiNPs.....	217
3.2.5. Synthesis of nanostructures based on SiNPs, AsNPs, TeNPs.....	224
3.3. Conditions for nanostructures formation by galvanic replacement y non-aqueous mediums.....	228
3.3.1. Galvanic replacement in organic solvents.....	228
3.3.2. Galvanic replacement in ionic liquids.....	235
3.4. Nanoscale galvanic replacement with the addition of a co-reducing agent.....	237
3.5. Usage of nanostructures synthesized by nanoscale galvanic replacement... References.....	242 253
4. SYNTHESIS OF SOLUTIONS OF STABILIZED METAL NANOPARTICLES IN SOLUTIONS BY GALVANIC REPLACEMENT.....	262
4.1. Mechanism of sonogalvanic synthesis of MNPs.....	262
4.2. Conditions of MNPs formation by sonogalvanic replacement.....	265
4.2.1. Synthesis of AgNPs.....	265
4.2.2. Synthesis of AuNPs.....	273
4.2.3. Synthesis of PtNPs, RuNPs.....	277
4.2.4. Synthesis of CuNPs.....	278
4.2.5. Synthesis of FeNPs CoNPs SnNPs.....	279
4.3. Usage of MNPs synthesized by sonogalvanic replacement..... References.....	280 284