

Contents

1	Introduction	1
1.1	Background of Research	1
1.1.1	Synthesis of Nanocrystalline Catalyst	2
1.1.2	Nanocrystal Catalysis	10
1.1.3	Pt–Ni Bimetallic Catalysts	13
1.2	Theme and Main Content of this Thesis	20
1.2.1	Opportunities and Challenges of Nanocatalysis	22
1.2.2	The Main Contents of This Thesis	26
	References	28
2	Controllable Synthesis of Water-Soluble Pt–Ni Alloys and the Study of Their Catalytic Properties	35
2.1	Introduction	35
2.2	Experimental Section	36
2.2.1	Chemicals and Instruments	36
2.2.2	Experimental Methods	36
2.3	Results and Discussion	38
2.3.1	Structural Characterization	38
2.3.2	Surface Modification of Water-Soluble Pt–Ni Alloy	43
2.3.3	Catalytic Performance of Pt–Ni Alloy in the Hydrogenation Reactions	45
2.4	Conclusions	50
	References	50
3	A Strategy for Designing a Concave Pt–Ni Alloy Through Controlled Chemical Synthesis	53
3.1	Introduction	53
3.2	Experimental Section	54
3.2.1	Chemicals and Instruments	54
3.2.2	Experimental Methods	55

3.3	Results and Discussion	56
3.3.1	Structural Characterization and Discussion	56
3.3.2	Etching Mechanism	58
3.3.3	The Catalytic Properties of Concave Pt–Ni Polyhedron	66
3.4	Conclusions	69
	References	69
4	Defect-Dominated Shape Recovery of Nanocrystals:	
	A New Strategy for Trimetallic Catalysts	71
4.1	Introduction	71
4.2	Experimental Section	72
4.2.1	Chemicals and Instruments	72
4.2.2	Experiment Methods	72
4.3	Results and Discussion	74
4.3.1	Second Growth of Ni and Shape Recovery of Nanocrystals	74
4.3.2	The Surface Defect Effects During the Growth of Nanocrystals	75
4.3.3	Design and Synthesis of the Trimetallic Core–Shell Pt–Ni@M Catalysts	79
4.3.4	The Study of the Catalytic Properties of the Trimetallic Core–Shell Pt–Ni@M Catalysts	82
4.4	Conclusions	90
	References	90
5	Sophisticated Construction of Au Islands on Pt–Ni:	
	An Ideal Trimetallic Nanoframe Catalyst	93
5.1	Introduction	93
5.2	Experimental Section	94
5.2.1	Materials and Instruments	94
5.2.2	Experimental Methods	95
5.3	Results and Discussion	97
5.3.1	The Corrosion of Truncated Octahedral PtNi ₃ Nanocrystals	97
5.3.2	The Analysis of the Etching Mechanism of Truncated Octahedral Pt–Ni NPs	98
5.3.3	The Synthesis of Au-Modified Pt–Ni Trimetallic Nanoframes	102
5.3.4	The Catalytic Properties of Au-Modified Pt–Ni Trimetallic Nanoframes	105
5.4	Conclusions	110
	References	110

Controlled Synthesis of Pt-Ni Bimetallic Catalysts and
Study of Their Catalytic Properties

Wu, Y.

2016, XII, 111 p. 79 illus., 62 illus. in color., Hardcover

ISBN: 978-3-662-49845-3