

CONTENTS

PREFACE	i
1. INTRODUCTION	3
2. DISCOVERY AND DEVELOPMENT OF THE URUSHIBARA CATALYSTS	8
2.1. Discovery of the Urushibara Catalysts	8
2.2. Development of the Urushibara Catalysts	10
3. THE VARIOUS URUSHIBARA CATALYSTS AND THEIR CHARACTERISTICS	17
3.1. Variety of Urushibara Catalysts	17
3.2. General Characteristics of the Urushibara Catalysts	20
3.3. Details on Individual Urushibara Catalysts	22
4. PREPARATION OF THE URUSHIBARA CATALYSTS	29
4.1. Urushibara Nickel Catalysts	29
4.2. Urushibara Cobalt Catalysts	53
4.3. Urushibara Copper Catalysts	55
4.4. Urushibara Iron Catalysts	56
4.5. Regeneration of the U-Ni-A Catalyst	59
5. CHARACTERISTICS OF THE CATALYSTS	61
5.1. Appearances and Microphotographs	61
5.2. X-ray Diffraction Studies, Part I	76
5.3. X-ray Diffraction Studies, Part II	92
5.4. Electron Diffraction Studies	102
5.5. Preservation of Catalytic Activity	104
5.6. Adsorbed Hydrogen on Urushibara Catalyst	107
6. DETAILED DESCRIPTION OF THE ACTIVITIES OF URUSHIBARA CATALYSTS	110
6.1. Effects of Reaction Conditions under Atmospheric Pressure	110
6.2. Effects of Reaction Conditions under High Pressure	116
6.3. Comparison with Raney Catalysts	123
6.4. Aspects of Individual Urushibara Catalysts	125
6.5. Selective and Partial Reductions	141
6.6. Steric Selectivity	150
6.7. Solvent Effect	153
7. VAPOR-PHASE HYDROGENATION	157

CONTENTS

7.1. Vapor-phase Hydrogenation in a U-tube Apparatus	158
7.2. Vapor-phase Hydrogenation with Sabatier's Apparatus . . .	161
8. APPLICATIONS	164
8.1. Hydrogenation and Hydrogenolysis	164
8.2. Hydrogenation with Heavy Hydrogen	202
8.3. Dehydrogenation	208
8.4. Reductive Desulfurization	209
8.5. Reductive Alkylation	212
8.6. Reductive Condensation	213
8.7. Hydration of Nitriles to Amides	215
APPENDIX CATALYTIC ACTIVITY OF PRECIPITATED METALS	221
A.1. Novel Catalytic Reduction with Water in the Presence of Precipitated Metals	221
A.2. Catalytic Activity of Precipitated Metals in Hydrogena- tion at Raised Temperatures	235
BIBLIOGRAPHY	241
INDEX	245