



Catalytic Amination for *N*-Alkyl Amine Synthesis

Feng Shi and Xinjiang Cui



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Preface

The chemistry of nitrogen-containing compounds is of significant importance in many crucial fields because they play key roles in the cases of preparation of agrochemicals, dyes, explosives, surfactants, additives, and so on. In addition, nitrogen derivatives are typical building blocks for life matter and bioactive compounds such as amino acids, nucleotides, vitamins, hormones, organic catalysts, and others. Among nitrogen-containing compounds, *N*-alkylamine is one of the most important compounds, and huge amount of attention has been given to this research area since the 1900s. Traditionally, *N*-alkylamines are synthesized using alkyl halides as alkylating reagents. However, this procedure is problematic due to amine over-alkylation, the toxic nature of alkyl halides, and the generation of inorganic salt waste. In order to achieve sustainable synthesis of *N*-alkylamines, there are several aspects of note. (1) The use of alkyl halides as alkylating reagents should be replaced by alcohol, amine, alkene, alkane, carbon dioxide, and other sustainable molecules; (2) the employment of amines as nitrogen sources can be replaced by nitrobenzene, nitrile, and ammonia to avoid multistep reactions; and (3) economic and efficient catalysts should be developed for the above transformations.

This handbook is intended to provide an overview of catalytic amination with amine, nitro-, and nitrile-containing molecules for *N*-alkylamine synthesis in the past 20–30 years or so, with emphasis placed not only on the amination reactions themselves, but also the development of the catalyst systems, i.e., from heterogeneous catalysis (1900–80) to homogeneous catalysis (1980–2010), and to the merging time of heterogeneous and homogeneous catalysis (2000–10). This handbook is organized in seven chapters to highlight the catalytic amination with different alkylating reagents, i.e., alcohol, amine, alkene/carbon monoxide, alkene/carbon monoxide/H₂, carbon dioxide, and alkane, and different nitrogen sources, i.e., amine, nitro-, and nitrile compounds. Although extensively valuable results were achieved in the last decades, the amination reactions with alkyl halides and aldehyde/ketone as alkylation reagents will not be included in this book as many positive reviews have been published in the last years.

It is a pleasure to be the editors of this handbook because it provides us with the opportunity to survey the field of catalytic amination for *N*-alkylamine synthesis and to honor the work of so many fine chemists. We gratefully acknowledge the Elsevier editorial staff, and extend special thanks to Katey Birtcher and Emily Thomson.