

# Preface

After the publication in 2004 of *Ruthenium catalysts and fine chemistry* co-edited by Bruneau and Dixneuf (Springer-Topics in Organometallic Chemistry series no. 11), the number of innovations brought by ruthenium catalysts has considerably increased.

The design and easy preparation of new ruthenium complexes that are equipped with functionally active ligands have led to the discovery of unprecedented activation processes with useful applications in catalysis for organic synthesis, offering interfaces with energy, molecular materials and polymers. From an emerging domain using ruthenium as “an element for the connoisseur”, ruthenium catalysis is now a mature field, widely explored with increasing contributions from industry. This is due to the availability of a large number of well-defined and stable ruthenium precatalysts offering several possible oxidation states, some of them being efficient in water. They tolerate and sometimes take profit of functional groups and have revealed catalytic activities for a wide range of selective chemical transformations with atom economy. New ruthenium catalysts are able to provide unique and multiple bond activation modes and make possible selective carbon–carbon, carbon–hydrogen, carbon–heteroatom bond formation and cleavage.

In this volume, innovative aspects of ruthenium applications in their contribution to green chemistry have been included, notably formation of hydrogen, hydrogenation and hydration of polar multiple bonds, stereoselective alkene metathesis, alkyne transformations via various activation modes,  $sp^2C-H$  and  $sp^3C-H$  bond activation and functionalization, photoredox catalysis and nanoparticles in catalysis.

This monograph is not intended to provide a comprehensive view of all ruthenium-catalyzed reactions, as this metal and its numerous complexes are now involved in many useful catalytic transformations. For instance, ruthenium-catalyzed carbonylation, polymerization, enantioselective hydrogenation and cyclopropanation... have not been included in spite of their high interest in synthesis.

Ten years after the first edition and because of the tremendous novelties that have recently appeared showing the fundamental role of ruthenium in catalysis, it was the appropriate opportunity to prepare the present volume, which should be helpful to researchers, teachers and students motivated by innovative and sustainable chemistry. It might also be a source of inspiration for new and unexpected catalytic transformations. We are grateful to the authors, experts in their domain, who have contributed by writing a chapter.

We dedicate this volume to all chemists and students who have made of ruthenium chemistry and catalysis a field for the future.

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