

# Preface

The metal-catalysed C–H bond dual activation and functionalisation have brought in the last two decades a revolution for the direct synthesis of complex molecules and molecular materials. Now the functionalisation of  $\text{sp}^2\text{C–H}$  bond for cross-coupled C–C or C-heteroatom bond formation presents advantages to replace, with better atom economy, the classical catalytic cross-coupling reactions involving a stoichiometric amount of an organometallic. In parallel the  $\text{sp}^3\text{C–H}$  bond activation, besides a faster access to natural products, is offering the possibility to functionalise alkanes in connection with renewable energy.

Whereas functional groups have shown efficiency to direct activation of neighbouring C–H bonds, as molecules containing multiple C–H bonds, the successive activations of several of these C–H bonds remain a challenge. Initially expensive metal catalysts have shown their efficiency to activate C–H bonds, but now many examples of cheap and environment-tolerant first-row metal catalysts are promoting useful activations. Examples of C–H bond functionalisation can now be performed in green solvents and even in water.

This volume gathers innovative contributions for a wide range of catalytic C–H bond functionalisations. They involve a variety of metal catalysts from Pd, Rh, Ir and Ru complexes to Fe, Ni, Cu and Ag derivatives, including surface organometallics, and they point out the importance of ancillary or transient ligands forcing the metal site to activate C–H bonds by several complementary processes. In addition this volume presents many new applications for cross C–C and C-heteroatom bond couplings and new synthetic methods, supported by mechanistic and computational studies, and examples of functionalisation of cyclopropanes or fullerenes and addresses problems of regioselectivity. The  $\text{sp}^3\text{C–H}$  bond activation reveals crucial aspects for the synthesis of natural products and for the dehydrogenation and functionalisation of alkanes.

The wide range of innovations presented here, on the concepts of C–H bond activations and their multiple profits, should be a source of inspiration for researchers and industry engineers to discover more efficient catalysts or to transfer the processes to industrial applications. They should attract teachers and students motivated by innovations, catalysis and sustainable development. They are

expected to initiate new ideas to discover new catalytic and cascade transformations.

We are grateful to all the chapter authors, experts in various complementary fields, who have contributed to create this multiple-facet volume.

We dedicate this volume to all chemists and students who are contributing, via C–H bond activation and functionalisation, to discover safe, catalytic transformations that will be profitable for our society.

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