Preface

For nearly a hundred years, the properties of organo-transition metal compounds have fascinated chemists and physicists from a scientific point of view. Although the enormous potential of these materials for opto-electronic applications was evident since long, a break-through came only about fifteen years ago after the demonstration that these compounds are well suited as emitters in highly efficient OLEDs (organic light emitting diodes). This is due to the specific properties of these materials with regard to the electroluminescent processes. In OLEDs, light emission proceeds via a recombination of electrons and holes leading to the formation of 25% singlet and 75% triplet excitons. The 75% triplet excitons are transferred into heat and hence are lost for the generation of light, unless spin-orbit coupling (SOC) induced by a transition metal ion opens a radiative path for the emission from the excited triplet to the singlet ground state. SOC induces also an efficient transfer from the populated 25% singlets to the emitting triplets. Thus, the total excitation energy is transferred to the emitting triplet states. This process is called *triplet harvesting*. In particular, due to these effects, OLEDs which contain organo-transition metal triplet emitters (phosphorescent emitters) can reach a four times higher efficiency than OLEDs built with purely organic singlet emitters (fluorescent emitters). Therefore, this book focuses on phosphorescent emitter materials, their photophysical properties, and their applications in OLEDs.

OLEDs have already started to be commercially applied in small and bright displays and entered the market which hitherto is governed by LCD or other technologies. Lighting by OLEDs comes also into the focus of commercial interests, since efficient and thin large-area lighting sources will become available in near future. The development of these new technologies is characterized by an exceptional interdisciplinary research in the fields of physics, chemistry, and material sciences. Thus, basic research meets applied sciences and industrial interests. Vice versa, the interplay in this field strongly stimulates basic sciences and fundamental material research. Hence, it can be expected that a number of fascinating new materials will be developed in the near future.

In this volume, leading scientists present comprehensive reviews, which provide insight into the emission properties of organo-metallic triplet emitters, the mecha-

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nisms of electroluminescence, the development of new emitter and host materials, and the improvement of OLED efficiencies by optimizing the emitter materials and the device architectures. The different contributions are written in a style which enables researchers from related fields and industrial laboratories as well as graduate students to follow the highly informative presentations. I am convinced that the contributions demonstrate the attractiveness and the great potential of the compounds and that further studies towards a better understanding of optoelectronic properties and mechanisms are induced. This will not only open large-scale applications of OLED displays and lighting systems, but will also stimulate the research and development of future applications in organic electronics, such as electrically pumped lasers or highly efficient and inexpensive organic solar cells.

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