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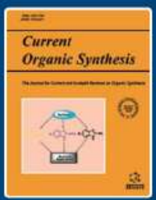

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Mini-Review Article

Recent Advances in Copper-Catalyzed Carbon Chalcogenides Cross- Coupling Reactions

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Abstract

Cu-catalyzed carbon-heteroatom bond formation is a powerful tool in the field of organic synthesis. In the past

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MINI-REVIEW ARTICLE

Recent Advances in Copper-Catalyzed Carbon Chalcogenides Cross-Coupling Reactions

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Abstract: Cu-catalyzed carbon-heteroatom bond formation is a powerful tool in the field of organic synthesis. In the past two decades, numerous Cu-based catalytic systems are developed in both homogeneous and heterogeneous forms. Important developmentshave been reported on Cu-based catalytic systems in the field of C-Chalcogenide cross-coupling in the last few decades. Where homogeneous Cu/L-based catalytic systems are found to perform reactions with high selectivity, heterogeneous supported-Cu and Cu-based nanoparticles are found to perform the reactions under sustainable conditions and high recyclability of catalytic systems. This present overview mainly focuses on the recent advances and applications in this fast-growing research field with an emphasis on copper-catalyzed cross-coupling generations of carbon-chalcogenide (S/Se/Te) bonds.

Keywords: Copper, selenium, sulfur, tellurium, cross-coupling, organo chalcogenides.

1. INTRODUCTION

The formation and necessity of carbon-heteroatom bond for the synthesis of organo-sulphides, selenides, and tellurides attract attention due to their profound applications in the field of catalysis [1], material science [2], biological, environmental, and pharmaceutical chemistry [3]. There has been an increasing interest in selenium and tellurium chemistry from the effective Se- and Te-based organocatalysts in several functional group transformations under sustainable conditions for the synthesis of bioactive molecules [4].

Transition metal-catalyzed cross-coupling reactions provide a powerful tool for the synthesis of a wide array of organic compounds *via* C-C and C-heteroatom cross-coupling within unsaturated carbon centres [3, 5-8]. However, the progress in carbon-chalcogen bond formation *via* copper-mediated or catalyzed cross-coupling reactions covers a variety of functional groups as well as the stability of starting materials and products due to the essentially required harsh reaction conditions, such as high temperatures-typically 150-200ºC and for the extended reaction time from several hours to few days [9]. Recently, environment-friendly nanocrystals were successfully applied for C-Se cross-coupling under benign conditions [10]. Although the chemistry of C-Te bond formation isstill in its early stages, the catalytic C-S and C-Se cross-coupling reactions *via* decyanative cross-coupling or nucleophilic addition of ArSe to aryl halides, aryldiazonium salts, and arylboronic acids have received a lot of attention in recent years [3, 8, 11-14]. Due to the catalyst poisoning nature of sulphur-containing compounds, it becomes the most challenging factor for C-S cross-coupling, whereas a small number of thiols or disulphides can destroy the catalytic activity [15]. However, the recent development of efficient catalytic systems has successfully ruled out the mentioned problems to perform C-S coupling. Catalytic investigation was further extended in performing C-Se and C-Te cross-coupling.

Catalytic systems with other transition metals like nickel [16], cobalt [17], and iron [18] have also been employed as catalysts; such systems suffer from serious drawbacks such as metal toxicity, low turnover numbers, *etc*. development of Cu-based heterogeneous catalytic systems were employed in such coupling reactions due to its low cost and ready accessibility. The use of Cu-based heterogeneous catalysts has the distinct benefit of decreasing the probability of Cu leaching from the surface. A large number of attractive Cu-catalyzed cross-coupling reactions have been reported by various research groups. In recent years, diarylchalogenides-containing C-S and C-Se bonds occur as component of drugs like AZD4407 [19a, b] vortioxetine [19c], chlorpromazine [19d] *etc*. These are effective and biologically active molecules against various diseases like cancer, HIV, Alzheimer's, asthma, Parkinson's, *etc*., demanding the continuous development in the synthesis of carbon-chalcogen compounds to meet the growing demand in many pharmaceutical applications [19]. As shown in

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