

Iron-Catalyzed 1,4-Arylalkylation of 1,3-Enynes with Arylborates and Unactivated Alkyl Electrophiles

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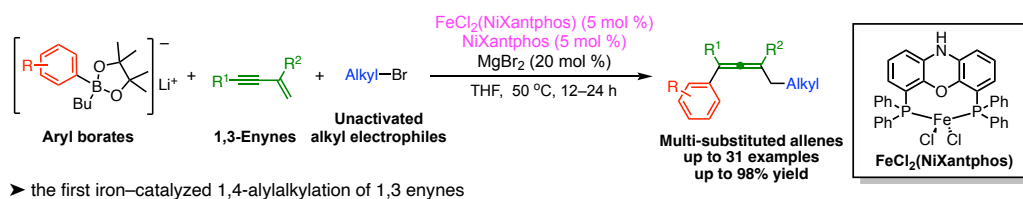
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Allene is one of the most versatile building blocks to construct complex molecular scaffolds in natural products and pharmaceuticals.¹ In recent years, transition metal-catalyzed 1,4-arylalkylations of 1,3-enynes have been proved a powerful strategy for the efficient synthesis of multi- or tetra-substituted allenes. Although the first-row transition metal catalysts significantly improved and complemented this reaction based on the single electron transfer process, only few reports have been published to this date.² Herein, we report the first iron-catalyzed radical 1,4-arylalkylation of 1,3-enynes with arylborates and unactivated alkyl electrophiles to afford tetra-substituted allenes (Scheme 1).

The three-component coupling reaction proceeds smoothly under mild conditions in the presence of magnesium bromide and catalytic amounts of iron-NiXantphos complex, providing the corresponding multi-substituted allenes in good to excellent yields. During the scope studies, we observed that several functional and heterocyclic substituent groups are well-tolerated in this reaction, demonstrating a broad substrate scope. Following the screening of several types of alkyl electrophiles, we noticed that the stability of the alkyl radical had a great impact on the reaction yields. To further prove this hypothesis, we performed several competitive or mechanistic reactions including radical scavenge reactions. In this presentation, we will report the detailed ligand screening and scope studies and discuss the possible reaction mechanism.

Scheme 1



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