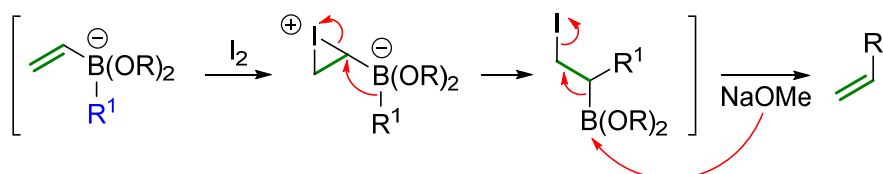


# ELECTROCHEMICAL TRANSFORMATION OF TETRAORGANO BORATES TOWARDS HIGHLY FUNCTIONALIZED ALKENES

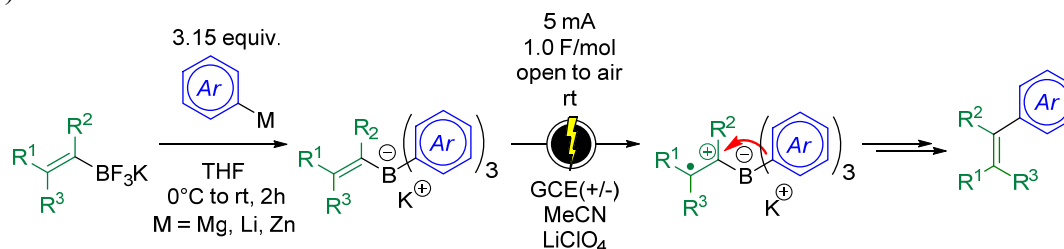
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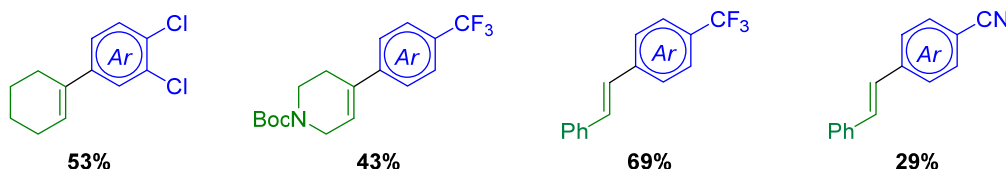
Inspired by the work of Zweifel in the late 1960s,<sup>[1]</sup> where the transition-metal-free olefination reaction with iodine was described (Scheme 1), we recently established “in-situ” generated bisorganoborinates in Zweifel olefinations.<sup>[2]</sup>



Based on that strategy, we envisioned a powerful and transition-metal-free alternative to olefination reactions, as many methods for the formation of functionalized alkenes require expensive and environmentally harmful transition-metal catalysts as well as inert and dry conditions. Therefore, we developed an unprecedented electrochemical coupling of aryls(heteroaryls) with alkenes *via* substituted tetraorgano borates (Scheme 2).



selected examples



The bench stable organoborate salts collapse into the desired functionalized alkenes *via* electrochemical oxidation under ambient conditions in an elegant fashion. As described by Geske and Waldvogel,<sup>[3]</sup> we propose an intramolecular mechanism. Therefore, we started our synthesis from cheap and readily available alkenyltrifluoroborate salts, which were then treated with various aryl(heteroaryl)metal (metal = Mg, Li, Zn) reagents, thus resulting in the desired (hetero)triarylborylborate salts. After a simple aqueous workup, these salts were then directly engaged in electrochemical transformations. Hereby, the reactions could be performed under ambient conditions in “wet” solvents, resulting in the desired functionalized alkenes in moderate to good yields over two steps (Scheme 2)

[1] (a) Zweifel, G.; Arzoumanian, H.; Whitney, C. C. *J. Am. Chem. Soc.* **1967**, *89*, 3652–3653. (b) Zweifel, G.; Polston, N. L.; Whitney, C. C. *J. Am. Chem. Soc.* **1968**, *90*, 6243–6245.

[2] Music A.; Baumann A. N.; Spieß P.; Hilgert N.; Köllen M.; Didier D. *Org. Lett.*, **2019**, *21*, 2189–2193.

[3] (a) Geske D. H. *J. Phys. Chem.* **1958**, *63*, 1062–1070. (b) Beil, S. B.; Möhle, S.; Enders, P.; Waldvogel, S. R. *Chem. Commun.* **2018**, *54*, 6128–6131.