Electrochemical C(sp^3)-C(sp^2) and C(sp^3)-C(sp) Bond Formation via Alkyl Boronates

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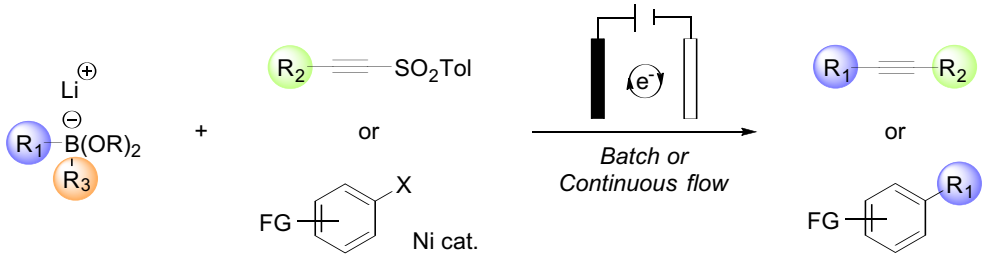
Electrochemistry is a powerful tool to induce a wide range of organic transformations under mild conditions,1 and has gained increasing importance in the field of sustainable chemistry.2 Indeed, the use of the electron as a green, renewable and traceless reagent for the generation of radicals intermediates and the formation of C-C bonds is more and more explored. However, the implementation of electrosynthesis in the chemical industry remains limited, mostly because of the challenges associated with scale-up.3 In recent years, great progress has been achieved with regard to electrochemical continuous processes using microreactor technology.4

For many years our group has been involved in the development of electrochemical processes.5 We will present our recent advances in the direct electrochemically mediated alkylation of readily available activated alkyl boronates either with acetylenic sulfones to form C(sp^3)-C(sp) bonds;6 or with aryl halides under nickel-catalysis to form C(sp^3)-C(sp^2) bonds via paired electrolysis. These oxidant-free transformations afford the desired product in moderate to quantitative yields under ambient conditions. The use of a microfluidic electro-cell enabled significant acceleration rates, increased productivity as well of a decreased of energy consumption.



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