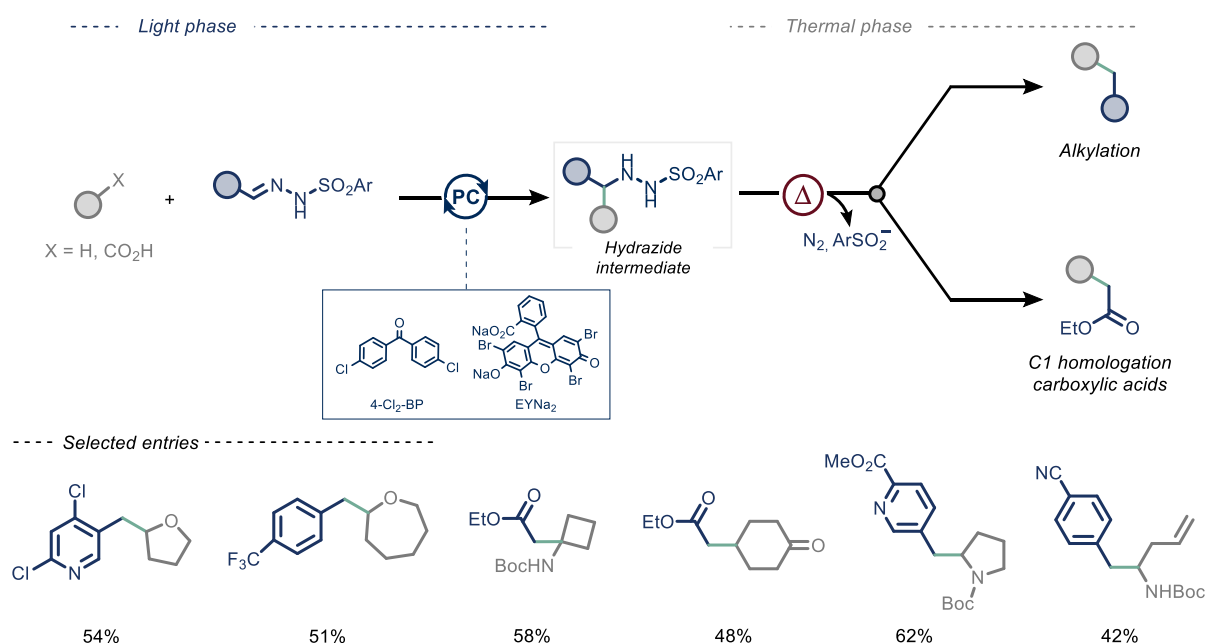


## Metal-free C(sp<sup>3</sup>)–C(sp<sup>3</sup>) bond formation using arylsulfonyl hydrazones in photocatalysis

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Nickel-mediated cross-electrophile (XEC) coupling has emerged as a potent strategy for constructing C(sp<sup>3</sup>)–C(sp<sup>3</sup>) bonds, utilizing various native and bench-stable aliphatic coupling entities.<sup>[1]</sup> Nevertheless, the exploitation of alternative ubiquitous functional groups such as aldehydes as coupling partner via a reductive deoxygenative pathway remains, to our knowledge, underdeveloped. Thus, an approach enabling the direct coupling of sp<sup>2</sup> and sp<sup>3</sup> electrophiles, such as aldehydes and largely present C(sp<sup>3</sup>)–H bonds or carboxylic acids, would represent an attractive strategy in the cross-electrophile coupling domain. To realize this goal, we were drawn to arylsulfonyl hydrazones, which are considered activated form of aldehydes due to their propensity to undergo radical addition, ultimately yielding deoxygenated, cross-coupled products upon thermal decomposition of alkylated hydrazide intermediates.<sup>[2]</sup> The use of cheap organic photoredox catalysts (PC) to promote the formation of the carbon radical would make the process metal-free. In this work, we demonstrated the realization of such strategy to forge C(sp<sup>3</sup>)–C(sp<sup>3</sup>) bonds from easily accessible arylsulfonyl hydrazones and abundant C(sp<sup>3</sup>)–H or carboxylic acid donors via a two-step synthetic strategy, comprising a first photocatalytic event (Hydrogen Atom Transfer or Single Electron Transfer) and a subsequent thermal fragmentation reaction.<sup>[3,4]</sup> This chemistry was applied to the synthesis of various homo-benzylic ethers, arylethylamines and β-aminoacids. Furthermore, this method was implemented for a safe C1 homologation of carboxylic acids using the ethyl glyoxalate-derived 4-CF<sub>3</sub>-phenylsulfonyl hydrazone reagent, now commercially available by Enamine Ltd.



[1] J. Choi, G. C. Fu, *Science* **2017**, 356, DOI 10.1126/science.aaf7230. [2] H. T. Dao, C. Li, Q. Michaudel, B. D. Maxwell, P. S. Baran, *J. Am. Chem. Soc.* **2015**, 137, 8046–8049. [3] A. Pulcinella<sup>†</sup>, S. Bonciolini<sup>†</sup>, F. Lukas, A. Sorato, T. Noël, *Angew. Chem. Int. Ed.* **2023**, 62, e202215374. [4] S. Bonciolini<sup>†</sup>, A. Pulcinella<sup>†</sup>, T. Noël et al., *Nat. Commun.* **2024**, 15, 1509.