Synthesis and properties of monoalkylsubstituted difluorocyclopropenes

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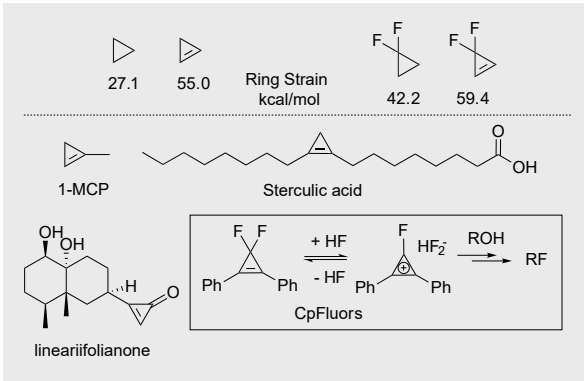
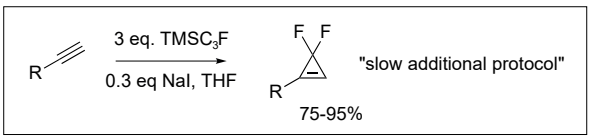
Introduction and Aim

The cyclopropenes are one of the of the most strained organic compounds. Nevertheless these compounds are found in nature and found an application as bioactive compounds and useful intermediates in organic synthesis (> 12 000 structures referred in Reaxys, 665 of them has annotated bioactivity)[1]. Meanwhile its difluorinated derivatives unlike saturated ones are less presented and studied (606 structures referred in Reaxys, no data about bioactivity) despite no significant increasing of the ring strain due to the fluorine introduction. It could be explained by its reaction ability due to the fluorinated aromatic cyclopropenium ion formation. The properties of difluorocyclopropene was recently utilized in design of new reagent ***CpFluor*** for the nucleophilic fluorination[2].

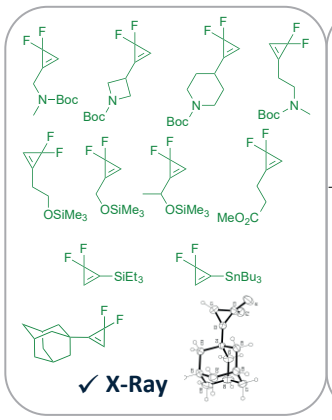
Recently in our group the "slow addition" protocol was proposed for difluorocyclopropanation of alkenes using $TMSCF_3$ as CF_2: source[3]. Herein, we report the application of the protocol to wide set of mono-substituted alkynes as well as stability studies of difluorocyclopropenes obtained.



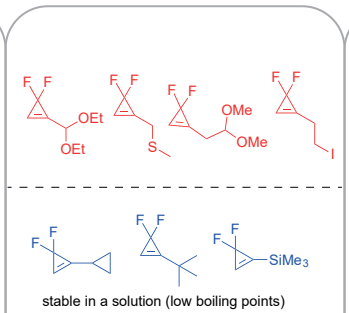
Synthesis



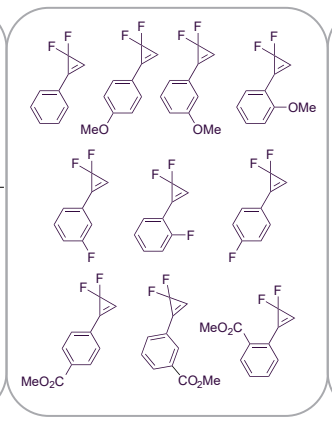
Stable at RT



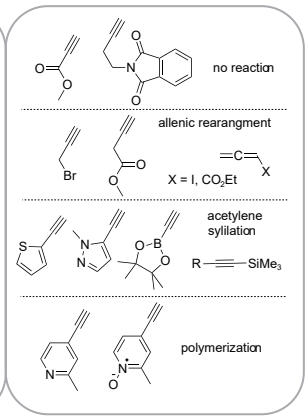
Stable in a solution



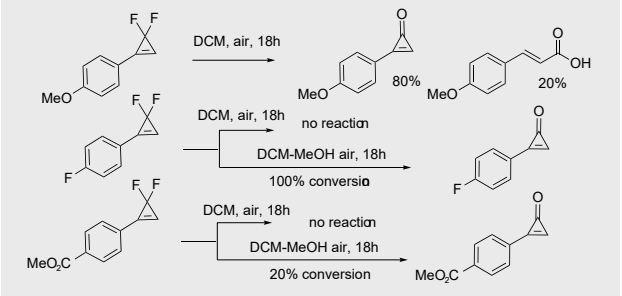
Unstable at rt on air

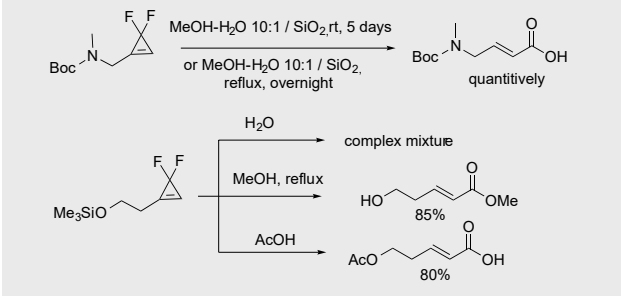


Limit of substrates



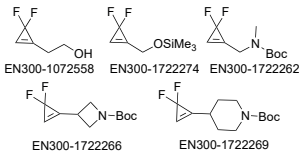
Hydrolysis





Results

It was showed that the ability of substituent R to stabilize the cyclopropenium ion is significant for the stability of corresponding difluorocyclopropenes. All aryl substituted ones could not be stored but introduction of EWG group into aromatic ring increased stability. Moreover aliphatic substituted difluorocyclopropenes possess the stability for the multi-gram synthesis and further storage at -4 °C at least 6 month, which make it attractive building blocks and intermediates for the organic synthesis.



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References

1. For resent review see: Vicente R Synthesis 2016; 48(15), 2343
2. Lingchun Li et al, Nat Commun. 2016; 7: 13320.
3. (a) Nosik, P.S. et al Adv. Synth. Catal. 2017, 359, 3126. (b) Nosik P.S. et al Adv. Synth. Catal. 2018, 360, 4104.