Ground state chemical reactivity under vibrational coupling to the vacuum field

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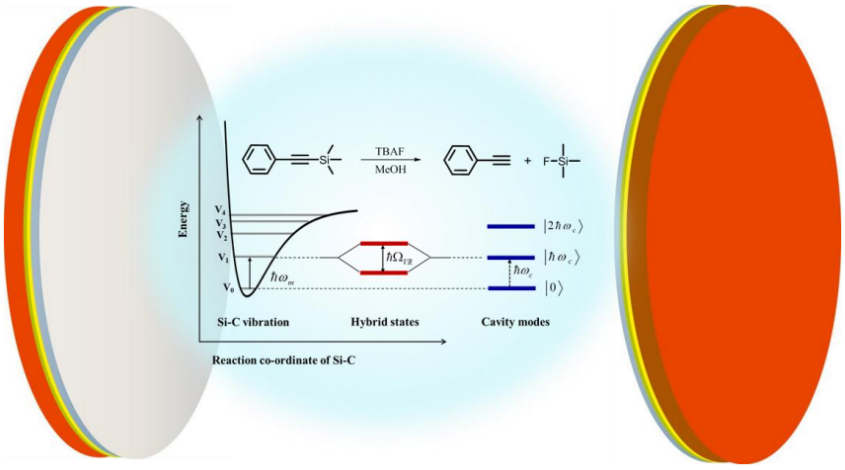
The ground-state deprotection of a simple alkynylsilane is studied under vibrational strong coupling to the zeropoint fluctuations, or vacuum electromagnetic field, of a resonant IR microfluidic cavity.[1] The reaction rate decreased by a factor of up to 5.5 when the Si-C vibrational stretching modes of the reactant were strongly coupled. The relative change in the reaction rate under strong coupling depends on the Rabi splitting energy. Product analysis by GC-MS confirmed the kinetic results. Temperature dependence shows that the activation enthalpy and entropy change significantly, suggesting that the transition state is modified from an associative to a dissociative type. These findings show that vibrational strong coupling provides a powerful approach for modifying and controlling chemical landscapes and for understanding reaction mechanisms.



Reference

[1] A. Thomas *et al*, *Angew. Chem. Int. Ed.* **2016**, *55*, 1 – 6