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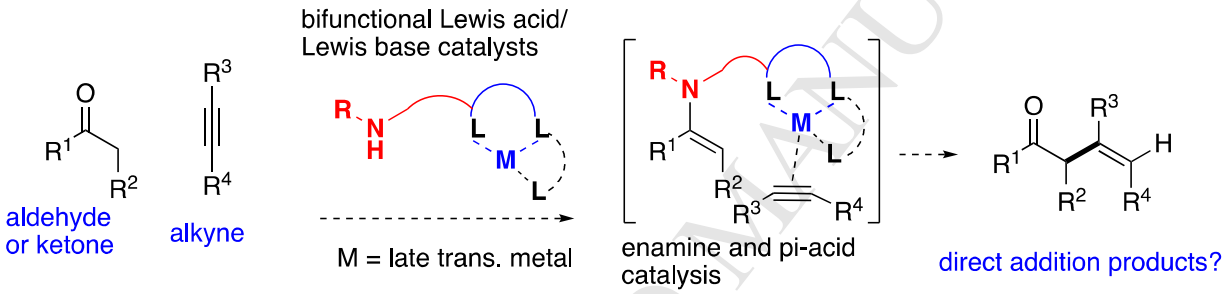
TABLE OF CONTENTS GRAPHIC



ABSTRACT

Bifunctional catalysts containing discrete metal pi-acid and amine sites were designed and investigated for the direct intermolecular addition of aldehydes and ketones to unactivated alkynes. Copper(I)-based catalysts were prioritized based on intramolecular (Conia-ene type) reactions, and complexes were designed with tridentate ligands and potentially hemilabile heterocyclic spacers. The structures of the designed catalysts were computed using density functional theory (DFT), and the relative energies of putative catalytic intermediates were estimated and used to prioritize catalyst designs. Novel bifunctional precatalysts containing a thiazole spacer were synthesized via a 9-step sequence and combined with transition metals before screening for the direct addition of aldehydes and ketones to several internal and terminal alkynes. Despite the lack of desired intermolecular reactions, DFT calculations of putative catalyst intermediates appears to be a promising strategy for the design and prioritization of bifunctional catalysts for C–C bond formation.

Keywords: alkenylation, copper(I), alkyne activation, hybrid catalysis, organocatalysis, aldehyde, ketone, alkyne, DFT, catalyst design