Catalyst-Controlled Regiodivergent Synthesis of 1,2- and 1-3-Aminothioethers

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Sulfur containing organic molecules are important synthetic intermediates, biologically active compounds, and ligands. Hydrothiolation of olefins, the addition of a hydrogen and a sulfur atom across a carbon–carbon double bond, is an atom economical approach to the synthesis and rapid diversification of these compounds. Compared to other hydrofunctionalization methodology, hydrothiolation is a much less developed field, likely due to the soft nature of the sulfur atom which often leads to catalyst poisoning. Our approach to hydrofunctionalization employs an olefin which contains a pendant-bound Lewis basic group. This Lewis base can coordinate to the metal center prior to the functionalization reaction thus increasing the effective concentration of the olefin and reduce catalyst poisoning.

We have found that allyl imines and amines are excellent directing groups in the hydrothiolation reaction affording either linear or branched products depending on the ligand used in the reaction. When ligands with large bite angles are employed, exclusive Markovnikov selectivity is observed, affording 1,2-aminothioethers. Conversely, when ligands with small bite angles are employed, the anti-Markovnikov product is observed and 1,3-aminothioethers are obtained. Initial mechanistic studies imply that similar oxidative addition/ migratory insertion/ reductive elimination mechanisms are occurring for both pathways. We hypothesize that the change in regioselectivity is an effect of diverging coordination spheres to favor either Rh–S or Rh–H insertion to form the branched or linear isomer, respectively.

