

The Role of Tetramethylethylenediamine (TMEDA) in Iron Catalyzed Cross-Coupling Reactions

Jeffrey D. Sears, Michael L. Neidig*

University of Rochester

Abstract: Many iron-catalyzed cross-coupling reactions have significantly enhanced reactivity and selectivity from the use of nitrogen-based additives and supporting ligands. Tetramethylethylenediamine (TMEDA) has been shown to decrease undesirable product distributions in several carbon-carbon coupling reactions involving Grignard nucleophiles. Mechanistic investigations aimed at elucidating the role of TMEDA in iron-catalyzed cross-coupling have been limited. Bedford and coworkers concluded that while transmetallated TMEDA-ligated iron species generate cross-coupled product from MesMgBr and *n*-octylbromide, these species are not reactive at rates relevant to catalysis. Therefore, the reason for TMEDA suppression of undesirable reactivity such as β -hydrogen elimination remains elusive. To investigate the role of TMEDA further, a synthetic physical-inorganic approach is highly desirable. Using ^{57}Fe Mössbauer spectroscopy, EPR spectroscopy and gas chromatographic monitoring of the catalytic cross-coupling of alkenyl Grignard reagents and alkyl electrophiles, insight into the precise role of TMEDA in iron speciation and cross-coupled product distributions was obtained. Several iron-centered intermediates have been isolated and characterized using XRD. These results will provide a framework to aid in the design and development of novel iron-catalyzed cross-coupling methodologies.