Nickel-Catalyzed Enantioconvergent Coupling of Racemic Partners

\[ \begin{align*}
\text{Conditions:} & \\
\text{A)} & \text{NiCl}_2 \cdot \text{glyme} (10 \text{ mol%), (S)}-\text{L1} (12 \text{ mol%), Ph}_2\text{P(CH}_2\text{)}_5\text{PPh}_2 (10 \text{ mol%), THF, –5 °C}} \\
\text{B)} & \text{NiCl}_2 \cdot \text{glyme} (12 \text{ mol%), (S)}-\text{L1} (15 \text{ mol%), Ph}_2\text{P(CH}_2\text{)}_5\text{PPh}_2 (9 \text{ mol%), THF, 5 °C}} \\
\text{C)} & \text{NiBr}_2 \cdot \text{glyme} (10 \text{ mol%), (S/R)}-\text{L2 (13 mol%), LiCl (1.2 equiv), THF, r.t.}}
\end{align*} \]

Selected derivatizations of products:

- BH$_3$ SMe$_2$, THF reflux
- LiAlH$_4$, THF, reflux
- Ts$_2$O, DTBMP, CH$_2$Cl$_2$, –78 °C
- Ph$_2$MgCl, THF, reflux
- BH$_3$ SMe$_2$, THF reflux
- Ts$_2$N, H$_2$O, cat. Cu, THF, r.t.
- AzT, cat. CuTc, toluene, 50 °C
- Ph$_2$Si, cat. LiAlH$_4$, THF, reflux
- Ts$_2$N, H$_2$O, cat. Pd, THF, r.t.
- Ts$_2$N, H$_2$O, cat. Cu, THF, r.t.

Selected examples:

- (C-L2) - 81% yield, 91% ee, dr > 99:1
- (C-L2) - 75% yield, 90% ee, dr > 98:2
- (A-L1) - 93% yield, 90% ee

Significance: Fu and co-workers report a nickel-catalyzed doubly enantioconvergent alkyl–alkyl coupling of racemic partners that proceeds with unprecedented selectivity. The authors employed a chiral nickel catalytic system that generates the product as a single stereoisomer from racemic propargylic halides and racemic β-zincated amides.

Comment: The authors propose that the enantioconvergence of the starting materials is facilitated by a radical intermediate arising from both starting materials. The presence of radical intermediates was inferred by the TEMPO adducts formed from both the electrophile and nucleophile partners in the mechanistic study.