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## Application of the Aluminum Reagents in Enantioselective Arylation of Aldehydes

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### Abstract

The catalytic asymmetric aryl addition of aldehydes has attracted much attention because the chiral diaryl alcohols are important intermediates to many biologically active compounds. After the asymmetric addition of diphenylzinc to aldehyde,<sup>[1]</sup> the mixed reagents of  $\text{Ph}_2\text{Zn}/\text{Et}_2\text{Zn}$ <sup>[2]</sup> and arylboronic acid/ $\text{Et}_2\text{Zn}$ <sup>[3]</sup> as aryl sources were developed to improve the enantioselectivity of the aryl transfer. Recently we have reported asymmetric additions of  $\text{AlAr}_3(\text{THF})$  to aldehydes<sup>[4]</sup> or ketones<sup>[5]</sup> catalyzed by the titanium(IV) complexes of (*R*)-H<sub>8</sub>-BINOL or (*S*)-BINOL. In this study, we develop a series of arylaluminum reagents for asymmetric arylation to aldehydes. The aluminum reagents include  $\text{AlPh}_3(\text{OEt}_2)$ ,  $\text{AlPh}_3(\text{DMAP})$ ,  $\text{AlPh}_3(\text{OPPh}_3)$ ,  $\text{AlEtPh}_2(\text{DMAP})$ ,  $\text{AlEtPh}_2(\text{OPPh}_3)$ , and  $\text{AlEt}_2\text{Ph}(\text{THF})$ .  $\text{AlEt}_2\text{Ph}(\text{THF})$  in solution is actually a mixture of  $\text{AlEt}_3(\text{THF})$ ,  $\text{AlEt}_2\text{Ph}(\text{THF})$ ,  $\text{AlEtPh}_2(\text{THF})$  and  $\text{AlPh}_3(\text{THF})$ . Distillation of the above mixture gave  $\text{AlEt}_3(\text{THF})$  and  $\text{AlPh}_3(\text{THF})$ . The asymmetric additions of the aluminum reagents to 1-naphthaldehyde were studied. Results showed that the supplemental ligands have a strong influence on the reactivity and enantioselectivity in the asymmetric arylation reactions.

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