**Introduction**

*n*-Butyllithium (*n*-BuLi) is one of the most prominent organolithium reagents in the whole of synthetic chemistry,\(^1\)\(^-\)\(^3\) and available as solutions in alkanes such as pentane, hexane, or heptane, which is usually encountered as a pale yellow solution. It is unstable towards air or moisture but stable in an atmosphere of nitrogen. It has been widely used in organic reactions, such as regioselective lithiation reaction,\(^4\) reversible metathesis reaction,\(^5\) Claisen rearrangement,\(^6\) phospho-Fries rearrangement,\(^7\) coupling reaction,\(^8\) asymmetric deprotonation–electrophilic trapping reaction,\(^9\) enantioselective hydroxyalkylation,\(^10\) etc. In general, *n*-butyllithium is commercially available and can also be prepared readily by the reaction of 1-bromobutane or 1-chlorobutane with Li metal (Scheme 1).\(^11\) An overview of the usage of *n*-BuLi in organic synthesis is presented below.

**Scheme 1**

(A) Fort and co-workers described an efficient method for the synthesis of polysubstituted furo[2,3-c]pyridines via successive regioselective lithiations, using *n*-BuLi or [*n*-BuLi/LiDMAE] as base. For each step the products were obtained in moderate to excellent yields.\(^5\)

(B) Bailey et al. reported mild and highly efficient experimental conditions for the reversible metathesis reaction known as the lithium–halogen exchange. The reaction products of 1-bromo-4-*tert*-butylbenzene with *n*-BuLi at 0 °C are obtained quantitative in heptane containing a small quantity of THF. Particularly, nettlesome side reactions, including coupling of aryllithium with the co-generated alkyl halide and formation of a benzyne intermediate via ortho-metallation of the aryl halide, are effectively avoided.\(^5\)

(C) Upon treatment with *n*-BuLi, a variety of allyl 1,1-dichlorovinyl ethers undergo rearrangement to furnish high yields of γ,δ-unsaturated esters after alcohol addition. A potential advantage of this method over other variants of the Claisen rearrangement is the ability to add a variety of alcohol nucleophiles to the proposed ketene intermediate, allowing the one-pot preparation of diverse esters of γ,δ-unsaturated carboxylic acids with high stereoselectivity.\(^6\)
(D) \( n\)-BuLi together with \( i\)-Pr\(_2\)NH has been used in the preparation of bifunctional BINOL ligands bearing phosphine oxides \([P(=O)R_2]\), phosphonates \([P(=O)(OR)_2]\), or phosphoramides \([P(=O)(NR_2)_2]\) at the 3,3\(^\prime\)-positions via a phospho-Fries rearrangement as key step. This method has an advantage with regard to yield and purification in comparison with a coupling method that uses halide compounds, expensive diphenylphosphine oxide \([\text{Ph}_2\text{P}(=\text{O})\text{H}]\), and palladium or nickel catalysts.\(^7\)

(E) Tarselli and Micalizio described a successful procedure for the coupling of aliphatic imines with allylic and allenic alkoxides enabled by a unique reactivity profile of Ti(IV) isopropoxide/\( n\)-BuLi compared to well-known Ti(IV) isopropoxide/RMgX systems. This coupling proceeds with moderate to excellent yields.\(^8\)

(F) An enantioselective hydroxyalkylation of \( \omega\)-tolualdehyde and 3-amino tetrahydrofurans (or 3-amino pyrrolidines, 3-amino tetrahydrothiophenes) in the presence of \( n\)-BuLi and lithium amides gives the target product 1-\( \omega\)-tolylpentan-1-ol in good yield and moderate ee.\(^10\)

(G) The highly pyramidalized alkene pentacyclo[4.3.0.0\(^2,4\).0\(^3,8\).0\(^5,7\)]non-4-ene was successfully synthesized with \( n\)-BuLi via dehalogenation of vicinal dihalides. The method has proven to be reliable for the synthesis of a variety of strained alkenes.\(^12\)

(H) Luliński et al. found that lithiated benzonitriles can be generated in high yields from reactions of bromobenzonitriles with \( n\)-BuLi in THF under standard cryogenic conditions (ca. \(-70\) °C, even up to \(-60\) °C). The reverse addition mode is employed to reduce significantly side reactions.\(^13\)

References