

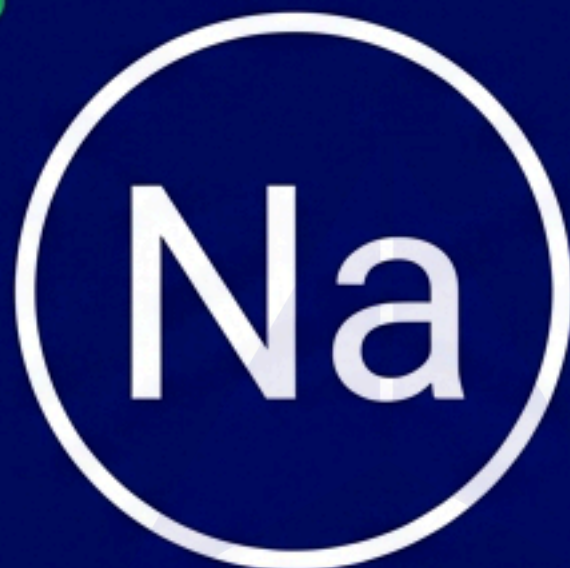
Coupling Reactions of Haloarenes

Synthesizing Alkylarenes and Biaryls via Metal Catalysis



The Reaction Environment: Sodium in Dry Ether

Key Concept



The Driver

Sodium metal acts as a powerful reducing agent. It drives the coupling by reacting with the halogen atoms on the starting molecules to extract them as stable sodium halide salts (e.g., NaX), freeing the carbon atoms to bond with one another.

Alert



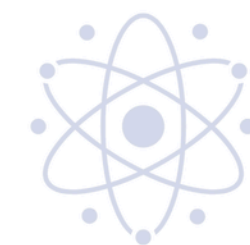
The Solvent

Reactions must be strictly anhydrous (dry ether). Moisture provides protons that would instantly quench the reactive intermediates. This converts the halides into simple, unwanted hydrocarbons instead of the desired coupled products.



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$$E=mc^2$$



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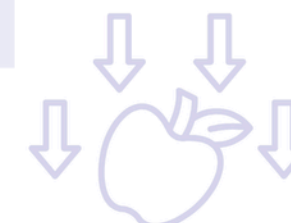
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Wurtz-Fittig Reaction



The defining feature of the Wurtz-Fittig reaction is the cross-coupling of an aromatic ring with an aliphatic chain to form an alkylarene.

Fittig Reaction



The defining feature of the Fittig reaction is the homo-coupling of two identical aromatic rings to synthesize a biaryl compound.

Naming Conventions & Reaction Matrix



Reaction Name	Reactant 1	Reactant 2	Final Product
Wurtz Reaction	Aliphatic R-X	Aliphatic R-X	Alkane R-R
Wurtz-Fittig	Aromatic Ar-X	Aliphatic R-X	Alkylarene Ar-R
Fittig Reaction	Aromatic Ar-X	Aromatic Ar-X	Biaryl Ar-Ar

Note: All reactions share the same 2Na / Dry Ether mechanism and produce 2NaX as a byproduct.

Reaction Summary & Constraints



The Mechanism

Sodium in dry ether drives the coupling by extracting halogens to form highly stable NaX salts, leaving carbon radicals/ions that immediately bond.



The Versatility

Wurtz, Wurtz-Fittig, and Fittig represent a continuous, modular spectrum of carbon-carbon coupling, allowing predictable bridging of Alkyl-Alkyl, Aryl-Alkyl, and Aryl-Aryl groups.



Warning: Low Reactivity

Aryl halides are incredibly resistant to standard nucleophilic substitution because resonance creates a partial C-X double bond, carbon is sp^2 hybridized. Coupling with active metals is a reliable bypass to force C-C bond formation.



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