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Funkcjonalizacja alkinów katalizowana związkami metali przejściowych = Transition metal catalyzed functionalization of alkynes

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Streszczenie

Alkynes are among the most valuable compounds in synthetic organic chemistry due to their versatile reactivity, which allows them to be transformed into valuable derivatives with interesting properties. The presence of a C≡C triple bond in the structure opens numerous possibilities for functionalization and structural expansion through the introduction of new substituents. Transition metal-catalyzed reactions of alkynes are powerful tools for the formation of new bonds, including H–C, C–C, and X–C (where X = N, Si, B, etc.). Many examples of catalytic hydrogenation (addition of H2), hydration (addition of H2O), hydroarylation (addition of an aryl group and hydrogen to the C≡C bond) and hydroamination (addition of an N–H moiety to the C≡C bond) processes have been described over last decades, which allow for the production of a wide range of organic derivatives - from alkanes and unsymmetrical olefins to organic products containing a C–N, C=N or C=O bonds. This useful toolbox can be further expanded by catalytic hydrosilylations or hydroborations of alkynes, providing access to the selective synthesis of compounds containing carbon–silicon bonds or unsaturated organoboron compounds, respectively. Alkynes can also undergo coupling reactions, where, for example, the dimerization reaction leads to the formation of 1-en-3-yne isomers, which contain double and triple bonds in their structure – a structural unit found in natural and biologically active products. Moreover, the cyclotrimerization of alkynes is currently used in the synthesis of benzene derivatives with extended substituents. Finally, the Sonogashira reaction involves the formation of a bond between C(sp) and C(sp2) carbon atoms and allows the preparation of substituted unsymmetrical internal alkynes with aryl groups. In this review article, we present the state-of-the-art of alkyne reactions catalyzed by transition metal coordination compounds. The significant practical importance of these reactions stems from the numerous applications of the resulting products, which, due to their biological activity, could be of interest to produce pharmaceuticals with anticancer, anti-inflammatory, antifungal, and antibacterial properties. Functionalized alkynes may also find applications in the production of functional materials, including conductive materials, polymers, or liquid crystals.

Słowa kluczowe

alkyne, catalysis, Sonogashira coupling, hydration reactions, hydroamination reaction

alkiny, kataliza, sprzęgania Sonogashira, reakcje hydratacji, reakcje hydroaminowania

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