

samples from silicon carbide by spark plasma sintering. The ceramics products were investigated by scanning electron microscopy (SEM) by Hitachi TM 3000. It has been established that using sintering additives and ultrafine powders it is possible to receive high-strength silicon carbide ceramics. The

sample with the highest density and hardness values was obtained in a series of experiments using silicon carbide powder from plasmadynamic synthesis and using Al–B–C sintering additives: $\rho = 3.12 \text{ g/cm}^3$; $H_{av} = 26 \text{ GPa}$.

References

1. Wu R. et al. *Recent progress in synthesis, properties and potential applications of SiC nano-materials // Progress in Materials Science, 2015.– Vol.72.– P.1–60. Harris G.L. (ed.). Properties of silicon carbide // Iet, 1995.– №13.*
2. Andrievski R.A. *Nano-sized silicon carbide: synthesis, structure and properties // Russian Chemical Reviews, 2009.– Vol.78.– №9.– P.821.*
3. Sivkov A., Nassyrbayev A., Gukov M. *Dependence of the Product's Phase Composition on the Ratio of Precursors in Plasmadynamic Synthesis of Silicon Carbide // Key Engineering Materials, 2018.– Vol.769.*
4. Cho K.S. *Microstructure of Spark Plasma Sintered Silicon Carbide with Al–B–C / K.S. Cho, Z.A. Munir, H.K. Lee // J. Ceram. Process. Res., 2008.– Vol.9(5)– P.500–505.*

ARYLATION OF ALKANES USING ARENDIAZONIUM TOZYLATES

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Aromatic diazonium salts have been known as one of the most valuable building blocks in organic synthesis. Considerable attention has been paid to the evaluation of their reactivity in the various transformations with the formation of new carbon-carbon bonds [1–3]. One of the most well-known reactions is the arylation of alkenes by the Matsuda-Heck mechanism.

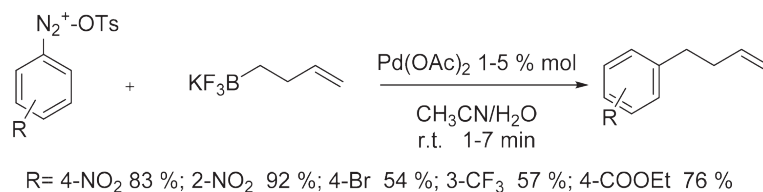
Previously, we showed that arenediazonium tosylates is able to arylate potassium vinyltrifluoroborate in the presence of 1 mol % Pd(OAc)₂ at room temperature [4]. In this contribution, we investigated the possibility of the formation of C_{sp2}–C_{sp3} bonds in Pd-catalyzed cross-coupling with potassium alkytrifluoroborates.

As a model substrate, we selected potassium methyltrifluoroborate and potassium (3-butynyl) trifluoroborate. The reaction was carried out under similar conditions, as shown earlier [4].

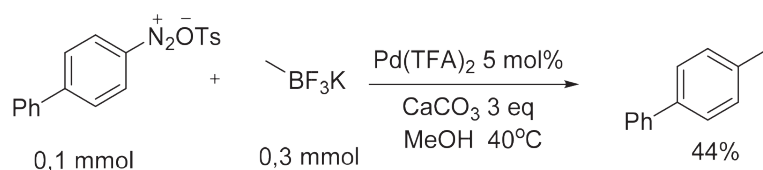
It was found that the arylation of potassium (3-butynyl)trifluoroborate proceeded smoothly with high reaction rate forming the desired product with high yields (from 57 to 92%).

On the other hand, the arylation of potassium methyltrifluoroborate required the increased temperature. The optimization of the reaction conditions allowed to achieve the 44% yield of desired methylbiphenyl in the presence of Pd(TFA)₂ and CaCO₃ as a base.

At present, the optimization of the reaction conditions is finished. When varying reaction conditions, we obtained better results using Pd(OAc)₂ in methanol. It was found that arylation of potassium methyltrifluoroborate with biphenyldiazonium



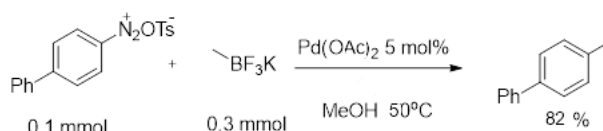
Scheme 1.



Scheme 2.

tosylate can be carried out with the yield of target methyl biphenyl up to 82%.

The research showed the possibility of catalytic arylation of alkanes and also showed the possibility of $C_{sp^3}-C_{sp^2}$ bonds formation. We once again proved the practical importance of arenediazonium tosylates in organic synthesis.



Scheme 3.

References

1. Roglans A. et al // *Chem. Rev.*, 2006.– 106.– 4622–4643.
2. Felpin F.-X. et al // *Chem. Eur. J.*, 2010.– №16.– 5191–5204.
3. Majek M. et al // *Beilstein J. Org. Chem.*, 2014.– №10.– 981–989.
4. Trusova M.E. et al // *Org. Chem. Front.*, 2018.– №5.– 41.

NEW SYNTHESIS OF IMINODIACETATE LIGANDS

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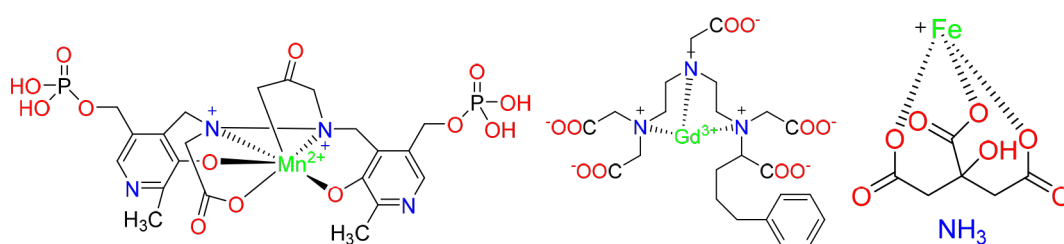
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Timely diagnosis is one of the most important ways to maintain human health. Because it's easier to prevent diseases, than cure it. One of the most informative types of diagnosis is magnetic resonance imaging (MRI). It allows specialists to accurately examine the internal organs and systems of the human body. Contrast agents are used to improve the visualization of diseases and areas affected. With their help specialists can not only to determine the location of the neoplasm, but also its size and structure. As such agents, substances based on ions

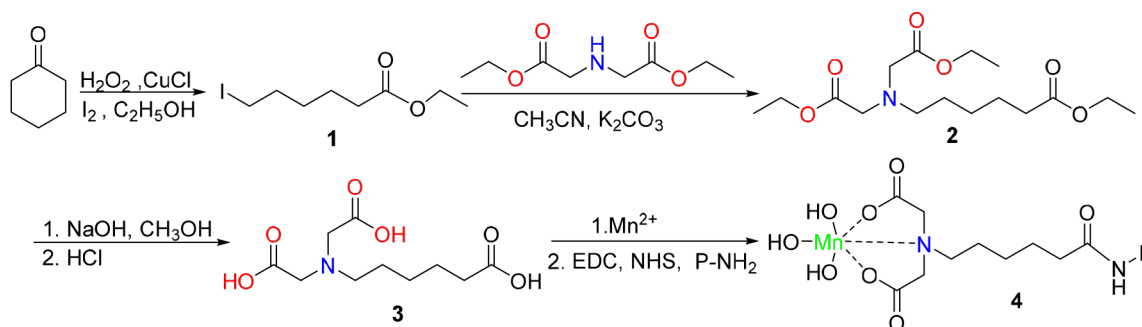
of gadolinium, manganese, iron, chromium, etc. (Scheme 1).

For a long time, gadolinium-based compounds were the most popular among contrast agents. But these agents are very toxic and cause fibroses. Consequently, specialists are looking for safer alternatives.

To reduce their toxicity, they are introduced into the complex, as a rule, with such ligands, as diethylenetriaminepentaacetic acid (DTPA), ethylene diamine tetraacetic acid (EDTA), or with their de-



Scheme 1. Different contrast agents



Scheme 2. General synthesis scheme