

Materials based on iron-catalyzed synthesis

We are looking for companies interested in developing new applications of our materials.

Background

The production of semiconductors, OLED displays, all-solid-state batteries, agrochemicals, pharmaceuticals, and fuel cells assumes the use of rare metals such as palladium as catalysts. However, rare metals are toxic and expensive due to limited supply. Iron, on the other hand, is an abundant inexpensive metal with low toxicity which makes it suitable for multiple applications including the manufacturing of electronics and medical products.

Technical Summary

The inventors synthesize a variety of functional molecules using iron-based catalysis. They developed novel iron-bisphosphine complexes with a phosphorus ligand, SciOPP, which have shown excellent performance in C-C cross-coupling reactions (Fig. 1, Adak et al. 2021).

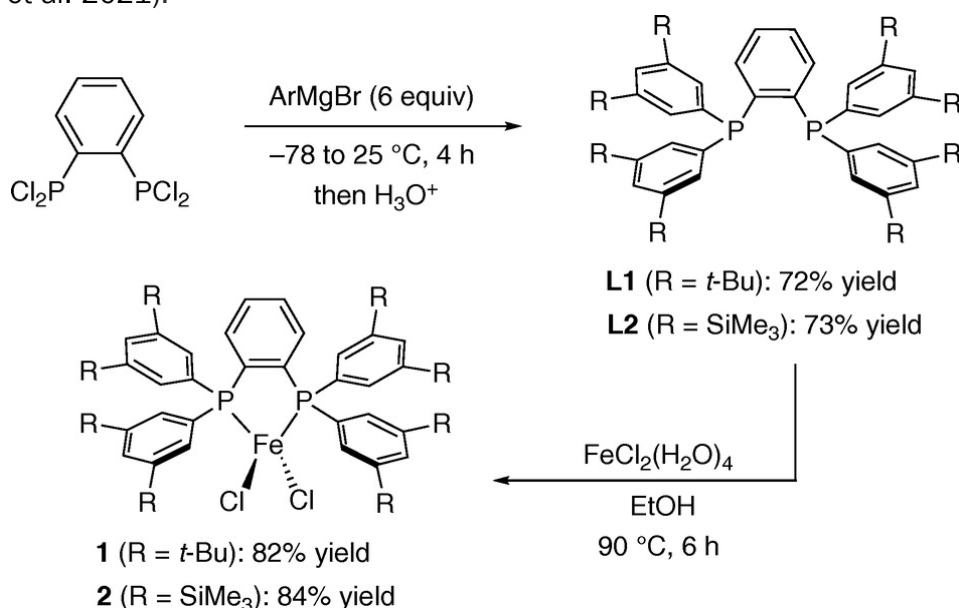


Figure 1. Syntheses of iron-bisphosphine complexes.

As a proof of concept, the inventors evaluated the performance of blue OLED devices using their new materials. They showed that the device could be driven at a lower voltage compared to conventional materials (Fig. 2). By implementing iron-catalyzed reactions, it is possible to reduce the catalyst cost to at least 1/16 compared to palladium. The overall cost of display production can be reduced to 1/3.

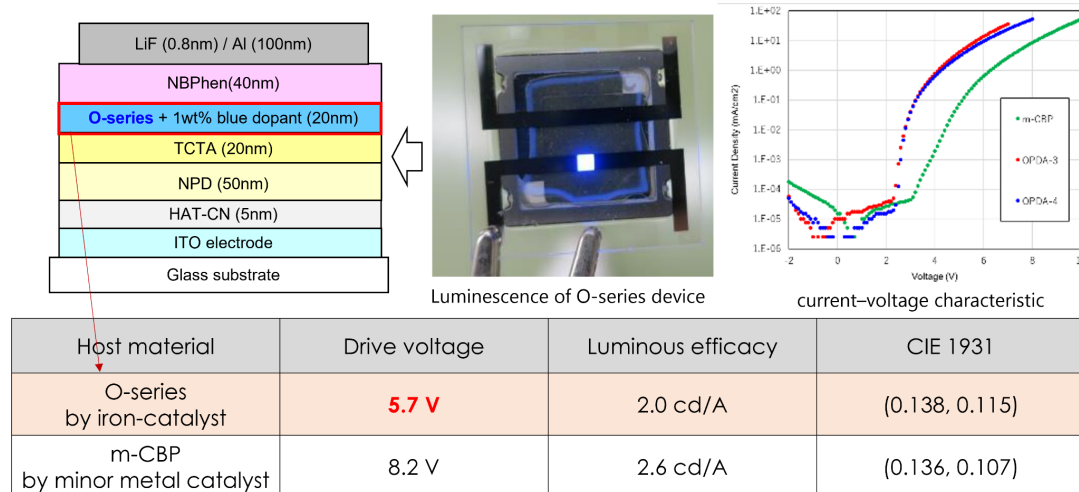


Figure 2. Comparison of iron-catalyst based and conventional

TSK is a company that develops materials based on iron-catalyzed synthesis in collaboration with Kyoto University.

Development Status

- Various OLED materials have been synthesized using iron catalysts

Applications

- Electronics
- Fuel cells
- All-solid-state batteries
- Medicinal products
- Agriculture (fertilizers, etc.)

Intellectual Property

- Licensing
- Option to license (for feasibility study)

※Patent Granted

Publications

Adak L, Hatakeyama T, Nakamura M. Iron-Catalyzed Cross-Coupling Reactions Tuned by Bulky Ortho-Phenylene Bisphosphine Ligands. *BCSJ* 2021; 94: 1125–1141.

Nakamura M, Matsuo K, Ito S, Nakamura E. Iron-catalyzed cross-coupling of primary and secondary alkyl halides with aryl grignard reagents. *J Am Chem Soc* 2004; 126: 3686–3687.