Development of the Ir-complex catalysts immobilized on functional polymer for formic acid dehydrogenation

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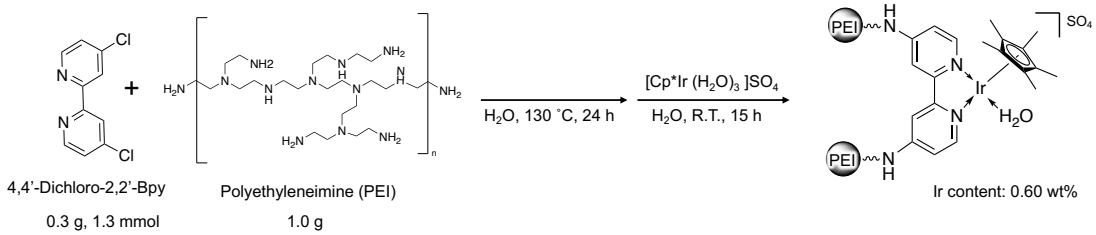
Due to the recent attention on hydrogen energy, we have proposed the use of formic acid (FA) as a hydrogen carrier.[1,2] Because FA has a high hydrogen storage capacity (53 kg/m^3, 4.3 wt%), and has several advantages such as high stability, low toxicity, low flammability, and ease of storage and reserve. Recently, we reported the efficient homogeneous Ir catalysts for formic acid dehydrogenation (FADH),[1,2] and these catalysts enabled the production of high-pressure hydrogen gas above 150 MPa at 80 ˚C.



Scheme 1. Synthetic scheme of Ir catalysts immobilized on polymer

For the practical use of FADH, immobilization of these catalysts is necessary in the flow-type continuous hydrogen production. Herein, we synthesized the Ir-based catalysts immobilized on functional polymers and evaluated these catalytic properties toward FADH activity and durability for a long-time reaction.

Scheme 1 shows a synthetic scheme of the Ir catalysts immobilized on polyethyleneimine (PEI).[3] As prepared catalysts showed high activities for FADH, and the total Turn Over Number (TON) of 7-cycle tests was 1.9×10^5 (Figure 1). In addition, we confirmed no decrease in Turn Over Frequency (TOF) values during 7-cycle tests (TOF = 1.5×10^4 h^{-1}). The details of catalyst synthesis, catalytic reaction and high-pressure hydrogen production are presented.

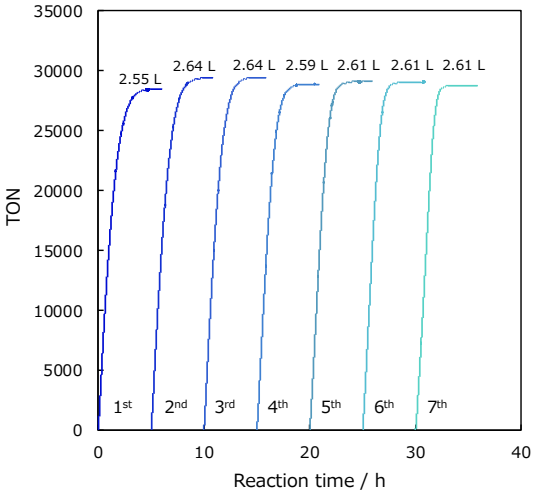


Figure 1. Formic acid dehydrogenation using the immobilized Ir catalysts

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