**Shvo’s Diruthenium Complex**

\[
[(\eta^5-C_4Ph_4COHOC_4Ph_4-\eta^5)(\mu-H)(CO)_4Ru_2]
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### Introduction

After robust diruthenium complex 1 was reported by Shvo,\(^1\) it found enormous utility in organic synthesis as a versatile catalyst, and it is now called Shvo complex. The main reason for its efficient catalytic activity is that it dissociates into 2 and 3 in the reaction mixture under thermal conditions. The 16-electron species 2 and 18-electron complex 3 play vital roles in the catalytic cycle.\(^2\) Recently, a modified procedure for the synthesis of Shvo complex was reported by Bäckvall and co-workers.\(^3\) Shvo complex serves as an effective catalyst in many organic transformations, including the reduction of aldehydes and ketones to alcohols,\(^4\) bimolecular disproportionation reaction of aldehydes to esters,\(^5\) isomerization of allylic alcohols\(^6\) and oxidation of alcohols.\(^7\) In addition, Shvo complex as a racemization catalyst in dynamic kinetic resolution (DKR) is well precedented.\(^8\)

### Preparation

Shvo complex can be synthesized from \(\text{Ru(CO)}_3(\eta^4-\text{Ph},_4\text{C}_4\text{CO})\), which is made from \(\text{Ru}_3(\text{CO})_{12}\) and tetraphenylcyclopentadienone.\(^3\)

### Abstracts

(A) Shvo complex catalyzed the in situ racemization of secondary alcohols, which then underwent enzyme-catalyzed DKR, in the preparation of enantiomerically pure acetates.\(^3\) The same catalyst has also been used for the racemization of amines and then applied to the synthesis of enantiomerically pure amines.\(^9\)
(B) The combination of enzyme-catalyzed DKR and an aldol reaction provided an access to β-hydroxy ester derivatives with high enantiomeric purity in a one-pot procedure using Shvo complex as catalyst for racemization.\(^{(10)}\)

(C) Oxidation of 5-unsaturated 3β-hydroxy steroids to the corresponding 4-en-3-one derivatives can be achieved by acetone at reflux in the presence of a Shvo catalyst. The reaction proceeds via a ruthenium-catalyzed dehydrogenation and subsequent hydrogen transfer to acetone with concomitant double bond migration.\(^{(11)}\)

(D) Shvo complex is able to catalyze the transfer dehydrogenation of amines to imines under mild conditions using 2,6-dimethoxybenzoquinone as oxidant.\(^{(12)}\)

(E) Complex 1 serves as a catalyst precursor for the hydrogenation of alkynes.\(^{(13)}\)

(F) Efficient aerobic oxidation of alcohols was developed via biomimetic catalytic system. Complex 1 dehydrogenates the alcohol and the hydrogens abstracted are transferred to an electron-rich quinone. The hydroquinone thus formed is reoxidized by air with the aid of Co-Salen complex.\(^{(2a)}\)

References


