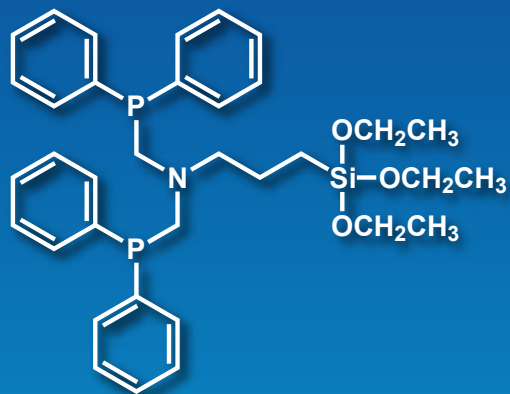


# Phosphine Ligand Immobilizable on Silica and Metal Oxide Surfaces



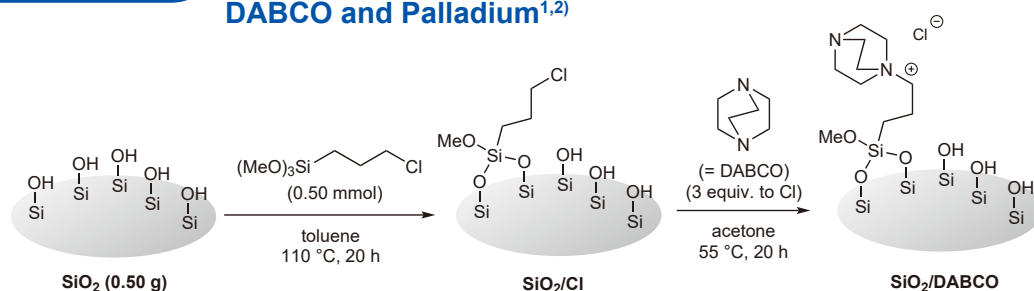
***N,N*-Bis[(diphenylphosphino)methyl]-3-(triethoxysilyl)propylamine**  
1g / 5g  
[B5594]

## Advantages

- Enables chemical immobilization on silica and metal oxide surfaces by silane coupling treatment.
- Bidentate coordination allows complexation with various metals.
- The immobilized carriers are expected to be applied to continuous flow synthesis.

## Application

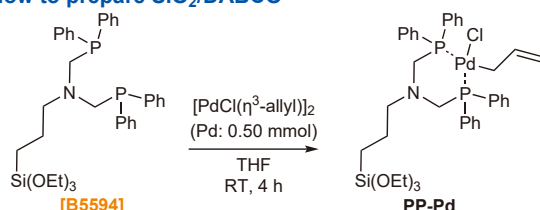
Highly active allylation catalyst with the synergistic effect of DABCO and Palladium<sup>1,2)</sup>



### How to prepare SiO<sub>2</sub>/DABCO

1. Mix silica with 3-chloropropyltrimethoxysilane in toluene. Heat the mixture at 110°C for 20 hours. Filtrate the mixture, then wash the residue with toluene, and dry it under reduced pressure to obtain SiO<sub>2</sub>/Cl.
2. Mix DABCO with SiO<sub>2</sub>/Cl in acetone. Heat the mixture at 55°C for 20 hours. Filtrate the mixture, then wash the residue with acetone, and dry it under reduced pressure to obtain SiO<sub>2</sub>/DABCO.

### How to prepare SiO<sub>2</sub>/DABCO

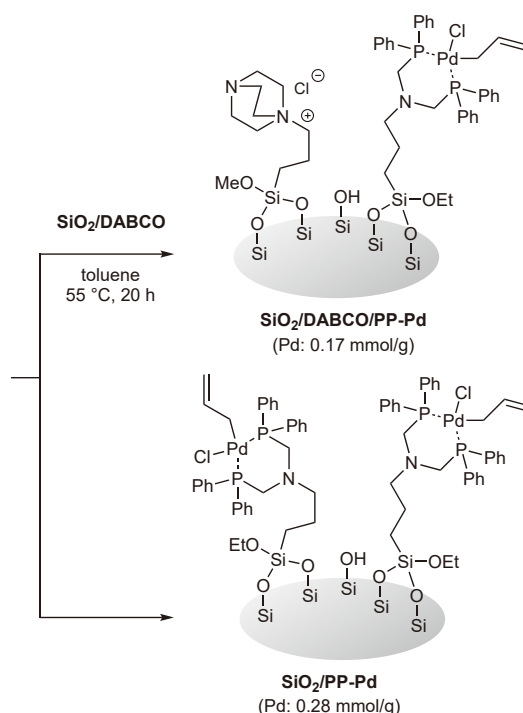


### How to prepare PP-Pd

Mix **B5594** and [PdCl(η<sup>3</sup>-allyl)]<sub>2</sub> in a 1 : 1 molar ratio to obtain PP-Pd.

### How to prepare SiO<sub>2</sub>/DABCO/PP-Pd

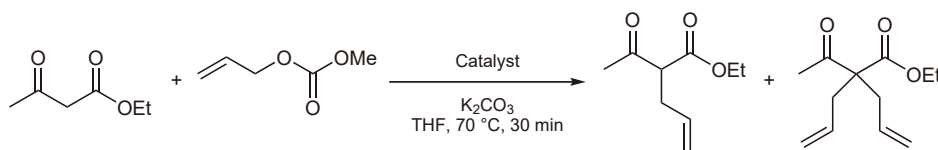
Mix PP-Pd and SiO<sub>2</sub>/DABCO in a 1 : 1 weight ratio in toluene. Heat the mixture at 55°C for 20 hours. Filtrate the mixture, then wash the residue with toluene, and dry it under reduced pressure to obtain SiO<sub>2</sub>/DABCO/PP-Pd.



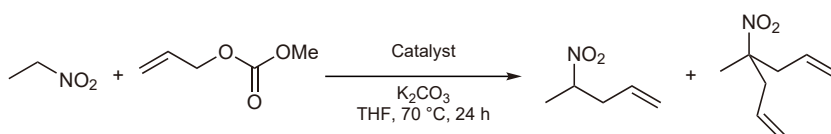
# Phosphine Ligand Immobilizable on Silica and Metal Oxide Surfaces

## Reaction 1

### Allylation using SiO<sub>2</sub>/DABCO/PP-Pd<sup>1,2)</sup>



Catalyst	Yield [%] (mono:di)
SiO <sub>2</sub> /DABCO/PP-Pd	97% (15:85)
SiO <sub>2</sub> /PP-Pd	83% (53:47)

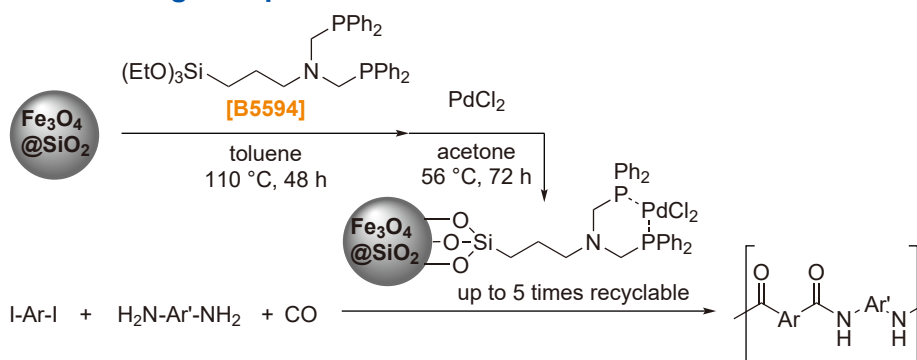


Catalyst	Yield [%] (mono:di)
SiO <sub>2</sub> /DABCO/PP-Pd	64% (0:100)
SiO <sub>2</sub> /PP-Pd	33% (44:55)
PP-Pd	13% (46:54)
PP-Pd + DABCO	30% (47:53)

Compared to SiO<sub>2</sub>/PP-Pd, SiO<sub>2</sub>/DABCO/PP-Pd shows higher catalytic activity for allylation.

## Reaction 2

### Synthesis of aromatic polyamides using palladium catalyst immobilized on magnetic particles<sup>3)</sup>



Active catalyst can be recovered by collecting the catalyst with a magnet after the reaction and washing it.

## References

- Co-Immobilization of a Palladium–Bisphosphine Complex and Strong Organic Base on a Silica Surface for Heterogeneous Synergistic Catalysis  
K. Motokura, K. Saitoh, H. Noda, Y. Uemura, W. Chun, A. Miyaji, S. Yamaguchi, T. Baba, *ChemCatChem* **2016**, 8, 331.  
<https://doi.org/10.1002/cctc.201501178>
- A Pd–bisphosphine complex and organic functionalities immobilized on the same SiO<sub>2</sub> surface: detailed characterization and its use as an efficient catalyst for allylation  
K. Motokura, K. Saitoh, H. Noda, W. Chun, A. Miyaji, S. Yamaguchi, T. Baba, *Catal. Sci. Technol.* **2016**, 6, 5380.  
<https://doi.org/10.1039/C6CY00593D>
- Synthesis of new fluorinated aromatic poly (ether ketone amide)s containing cardo structures by a heterogeneous palladium-catalyzed carbonylative polycondensation  
L. Liu, F. Zou, R. Zhang, M. Cai, *Polym. Adv. Technol.* **2018**, 30, 58.  
<https://doi.org/10.1002/pat.4443>

## Related Products

**3-Chloropropyltrimethoxysilane**  
**DABCO**

**Allylpalladium(II) Chloride Dimer (= [PdCl(η<sup>3</sup>-allyl)]<sub>2</sub>)**  
**Palladium(II) Chloride (= PdCl<sub>2</sub>)**

25mL / 100mL / 500mL **[C0840]**

25g / 100g / 500g **[D0134]**

500mg / 1g **[A1479]**

1g / 5g **[P1489]**

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