**Solvias catASium® Catalyst & Ligand Kit for Asymmetric Hydrogenation**

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
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<tbody>
<tr>
<td>96-6655</td>
<td>Solvias catASium® Catalyst and Ligand Kit for Asymmetric Hydrogenation</td>
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<table>
<thead>
<tr>
<th>Code</th>
<th>Name</th>
<th>Structure</th>
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<tr>
<td>15-0135</td>
<td>catASium® D(R)</td>
<td>![Structure 1]</td>
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<tr>
<td>45-0178</td>
<td>catASium® D(R)Rh</td>
<td>![Structure 2]</td>
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<tr>
<td>15-0108</td>
<td>catASium® M(R)</td>
<td>![Structure 3]</td>
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<tr>
<td>45-0173</td>
<td>catASium® M(R)Rh</td>
<td>![Structure 4]</td>
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<tr>
<td>45-0176</td>
<td>catASium® MN(R)Rh</td>
<td>![Structure 5]</td>
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<tr>
<td>45-0774</td>
<td>catASium® MNAn(R)Rh</td>
<td>![Structure 6]</td>
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<tr>
<td>45-0400</td>
<td>catASium® MNBn(R)Rh</td>
<td>![Structure 7]</td>
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<tr>
<td>45-0415</td>
<td>catASium® MNF(R)Rh</td>
<td>![Structure 8]</td>
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<tr>
<td>45-0750</td>
<td>catASium® MNN(R)Rh</td>
<td>![Structure 9]</td>
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<tr>
<td>15-0109</td>
<td>catASium® MNXyl(R)</td>
<td>![Structure 10]</td>
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<tr>
<td>45-0770</td>
<td>catASium® MNXyl(R)Rh</td>
<td>![Structure 11]</td>
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<tr>
<td>15-0117</td>
<td>catASium® MNXylF(R)</td>
<td>![Structure 12]</td>
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<td>45-0766</td>
<td>catASium® MNXylF(R)Rh</td>
<td>![Structure 13]</td>
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<tr>
<td>45-0752</td>
<td>catASium® MQF(R)Rh</td>
<td>![Structure 14]</td>
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<tr>
<td>15-0162</td>
<td>catASium® T1</td>
<td>![Structure 15]</td>
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<tr>
<td>15-1452</td>
<td>catASium® T2</td>
<td>![Structure 16]</td>
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<td>15-0164</td>
<td>catASium® T3</td>
<td>![Structure 17]</td>
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96-6655  Solvías catASium® Catalyst and Ligand Kit for Asymmetric Hydrogenation
Contains 100mg unit of the catASium® items listed on page 1

15-0108  (-)-2,3-Bis[(2R,5R)-2,5-dimethylphospholanyl]maleic anhydride, min. 97% [catASium® M(R)] [505092-86-4]
C_{36}H_{47}O_{3}P_{2}; FW: 526.66; white powd.  air sensitive
100mg 500mg
Note: Sold in collaboration with Solvías for research purposes only.  Patent WO 03084971.
Technical Note:
1.  See 45-0173.

15-0109  (-)-2,3-Bis[(2R,5R)-2,5-dimethylphospholanyl]-1-(3,5-dimethylphenyl)-1H-pyrrrole-2,5-dione, min. 97%
[catASium® MNXyl]
C_{37}H_{49}NO_{3}P_{2}; FW: 529.47; white powd.
100mg 500mg

15-0117  (-)-2,3-Bis[(2R,5R)-2,5-dimethylphospholanyl]-1-[3,5-bis(trifluoromethyl)phenyl]-1H-pyrrrole-2,5-dione, min. 95%
[catASium ® MNXylF(R)]
C_{38}H_{47}F_{6}NO_{3}P_{2}; FW: 537.42; white powd.
100mg 500mg

15-0135  (3R,4R)-(+)-Bis(diphenylphosphino)-1-benzylpyrrolidine, min. 98% [catASium® D(R)] [99135-95-2]
C_{35}H_{33}NP_{2}; FW: 529.59; white powd.; m.p. 120°C; [α]D 104.6° (c 1.0, CHCl₃)  air sensitive
100mg 500mg
Note: Sold in collaboration with Solvías for research purposes only.  Patent EP 151282.
Technical Notes:
1.  Enantioselective catalyst for the hydrogenation of Z-2-acetamidocinnamic acid.
2.  Highly enantioselective catalyst for asymmetric reductive amination.

CO₂H

NH₄

Ph

PPh₂

O

2 ArB(OH)₂

PPh₂

OAr

+ 2

Ph N

Ph N

2 5% Rh(acac)(cod)₂
5.5% Ligand
NEt₃, Mol Sieves
Dioxane, 50 °C

4 Examples
88-96% ee

References:

15-0162  (+)-(1S,4R)-3-[4-(Diphenylphosphino)-2,5-dimethyl-3-thienyl]-4,7,7-trimethylbicyclo[2.2.1]hept-2-en-2-yl)diphenyl-
phosphine, min. 96% [catASium®T1] [868851-47-2]
C_{36}H_{37}P₂S; FW: 614.76; white powd.
100mg 500mg

15-0164  (+)-(4-{(1R,4S)-3-[Diphenylphosphino]-1,7,7-trimethylbicyclo[2.2.1]hept-2-en-2-yl]-2,5-dimethyl-3-thien-3-yl}bis
(3,5-dimethylphosphino)phosphine, min. 95% [catASium®T3] [868851-50-7]
C_{36}H_{37}P₂S; FW: 670.87; white powd.
100mg 500mg
-3-

15-1452 (±)-(1S,4R)-3-[4-(Diphenylphosphino)-2,5-dimethyl-3-thienyl]-4,7,7-trimethylbicyclo[2.2.1]hept-2-2-yl]bis(3,5-dimethylphenyl)phosphino, min. 98% [catASium® T2]

[115x123]C_{27}H_{29}P_{2}; FW: 670.87; white to yellow pwd.; [α]_{D}^{+} 99.1 (c 1.0, CHCl_{3}) air sensitive

Note: Optical purity 97%


Technical Note:
1. Highly enantioselective catalyst for the hydrogenation of α- and β-acylamido acrylates or less functionalized olefins under mild conditions.


45-0173 (-)-2,3-Bis[(2R,5R)-2,5-dimethylphospholanyl]maleic anhydride(1,5-cyclooctadiene)rhodium (I) tetrafluoroborate, 98% [catASium® M(R)Rh] [507224-99-9]

[Rh(C_{10}H_{15}O_{3}P_{2})]BF_{4}^{-}; FW: 624.20; red-brown pwd. air sensitive

Note: Optical purity 96%

Sold in collaboration with Solvias for research purposes only. Patent WO 03084971.

Technical Notes:
1. Highly enantioselective catalyst for the hydrogenation of α or Z β-acylamido acrylates under mild conditions and low pressure.
2. Highly enantioselective for the hydrogenation of itaconates at room temperature.

References:

45-0176 (-)-2,3-Bis[(2R,5R)-2,5-dimethylphospholanyl]1-methyl-1H-pyrrole-2,5-dione(1,5-cyclooctadiene)rhodium (I) tetrafluoroborate, min. 97% [catASium® MN(R)Rh]

[Rh(C_{10}H_{15}NO_{3}P_{2})]BF_{4}^{-}; FW: 637.24; red-orange pwd. air sensitive

Note: Optical purity 95%

Sold in collaboration with Solvias for research purposes only. Patent WO 03084971.

Technical Note:
1. See 45-0173.

45-0178 (3R,4R)-(+)-Bis(diphenylphosphino)-1-benzylpyrrolidine(1,5-cyclooctadiene)rhodium (I) tetrafluoroborate, min. 97% [catASium® D(R)Rh]

[Rh(C_{35}H_{32}NP_{2})]BF_{4}^{-}; FW: 827.49; yellow pwd. air sensitive

Note: Optical purity min. 97%

Sold in collaboration with Solvias for research purposes only. Patent EP 151282.

Technical Note:
1. See 15-0135.

45-0400 (-)-3,4-Bis[(2R,5R)-2,5-dimethylphospholanyl]1-benzyl-1H-pyrrole-2,5-dione(1,5-cyclooctadiene)rhodium(I) tetrafluoroborate, min. 95% [catASium® MNBn(R)Rh]

[Rh(C_{23}H_{31}NO_{2}P_{2})]BF_{4}^{-}; FW: 713.34; orange pwd.

45-0415 (-)-3,4-Bis[(2R,5R)-2,5-dimethylphospholanyl]1-pentafluorophenyl-1H-pyrrole-2,5-dione(1,5-cyclooctadiene)rhodium(I) tetrafluoroborate, min. 95% [catASium® MNF(R)Rh]

[Rh(C_{22}H_{24}F_{5}NO_{2}P_{2})]BF_{4}^{-}; FW: 789.26; orange pwd.

References:
<table>
<thead>
<tr>
<th>Catalog Number</th>
<th>Description</th>
<th>Purity</th>
<th>Molecular Formula</th>
<th>Molecular Weight</th>
<th>Form</th>
<th>Notes/Technical Notes</th>
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<td>45-0750</td>
<td>(-)-4,5-Bis[(2R,5R)-2,5-dimethylphospholanyl]<a href="1,5-cyclooctadiene">1,2-dimethyl-1,2-dihydropyridazine-3,6-dione</a>rhodium (I) tetrafluoroborate, min. 95% [catASium® MNN(R)Rh]</td>
<td>100mg</td>
<td>Rh(C8H12)(C18H30N2O2P2)BF4</td>
<td>666.28</td>
<td>orange-brown pwdr.</td>
<td>air sensitive</td>
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<td></td>
<td>Note: Sold in collaboration with Solvias for research purposes only. Patent WO 03084971. Technical Note: 1. See 45-0173.</td>
<td>500mg</td>
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<td></td>
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<tr>
<td>45-0752</td>
<td>(-)-1,2-Bis[(2R,5R)-2,5-dimethylphospholanyl]-3,3,4,4-tetrafluoro-1-cyclobutene(1,5-cyclooctadiene)rhodium (I) tetrafluoroborate, min. 95% [catASium® MQF(R)Rh]</td>
<td>100mg</td>
<td>Rh(C8H12)(C8H13F4P2)BF4</td>
<td>652.19</td>
<td>orange to brown pwdr.</td>
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<td>45-0766</td>
<td>(-)-2,3-Bis[(2R,5R)-2,5-dimethylphospholanyl]-1-[3,5-bis(trifluoromethyl)phenyl]-1H-pyrrole-2,5-dione(1,5-cyclooctadiene)rhodium (I) tetrafluoroborate, min. 97% [catASium® MNXylF(R)Rh]</td>
<td>100mg</td>
<td>Rh(C13H19)(C19H23F6NO2P2)BF4</td>
<td>835.31</td>
<td>red to dark red solid</td>
<td>air sensitive</td>
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<td>Note: Sold in collaboration with Solvias for research purposes only. Patent WO 03084971. Technical Note: 1. See 45-0173.</td>
<td>500mg</td>
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<td>45-0770</td>
<td>(-)-2,3-Bis[(2R,5R)-2,5-dimethylphospholanyl]-1-[3,5-dimethylphenyl]-1H-pyrrole-2,5-dione(1,5-cyclooctadiene)rhodium (I) tetrafluoroborate, min. 97% [catASium® MNXyl(R)Rh]</td>
<td>100mg</td>
<td>Rh(C13H19)(C17H19NO2P2)BF4</td>
<td>727.36</td>
<td>red-brown solid</td>
<td>air sensitive</td>
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<td>Note: Sold in collaboration with Solvias for research purposes only. Patent WO 03084971. Technical Note: 1. See 45-0173.</td>
<td>500mg</td>
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<td>45-0774</td>
<td>(-)-2,3-Bis[(2R,5R)-2,5-dimethylphospholanyl]-1-[4-methoxyphenyl]-1H-pyrrole-2,5-dione(1,5-cyclooctadiene)rhodium (I) tetrafluoroborate, min. 97% [catASium® MNAn(R)Rh]</td>
<td>100mg</td>
<td>Rh(C13H19)(C23H31NO3P2)BF4</td>
<td>729.34</td>
<td>orange pwdr.</td>
<td>air sensitive</td>
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<td>Note: Sold in collaboration with Solvias for research purposes only. Patent WO 03084971. Technical Note: 1. See 45-0173.</td>
<td>500mg</td>
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