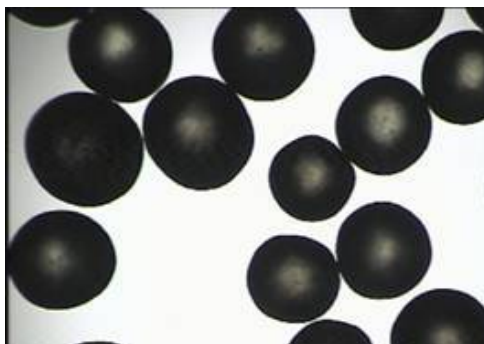


# Ni EnCat<sup>TM</sup>

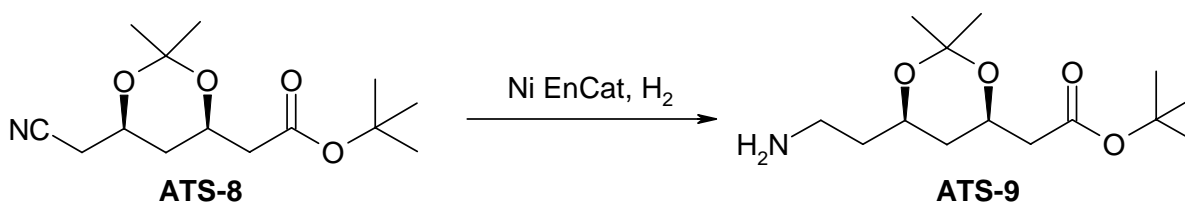
## Encapsulated Ni(0) catalysts - *beta test samples*

Samples of Reaxa's Nickel EnCat<sup>TM</sup> catalysts are now available for user testing



<b>Cleaner products</b>	reduced Ni and Al contamination versus other nickel catalysts
<b>Cleaner waste streams</b>	reduced metal losses in Ni EnCat <sup>TM</sup> processes
<b>Fast, efficient processes</b>	the EnCat <sup>TM</sup> beads filter easily
<b>No plant contamination</b>	metal remains trapped within the polymer bead
<b>Improved processes</b>	high activity and selectivity in many types of reduction reactions
<b>Process intensification</b>	EnCat <sup>TM</sup> can be used in batch and continuous flow processes

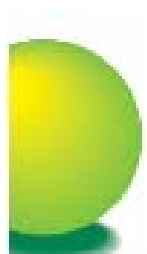
### Application: Hydrogenation of Atorvastatin intermediates



Activated Ni EnCat (12.5 wt% Ni on substrate) gave product with > 95 % purity (by HPLC); 85 % isolated yield..

### Ease of Use: Improved Safety Profile

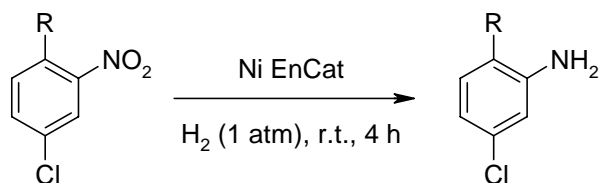
A key advantage of Ni EnCat over other sponge nickel catalyst is its reduced pyrophoricity. A sample of activated Ni EnCat was submitted to a standard pyrophoricity test (UN Pyrophoricity Test - Test N.2 method for pyrophoric solids) in which the Ni EnCat was allowed to dry out in exposure to air. No pyrophoricity or heating of the sample was detected.



# Ni EnCat™

## Applications

### Nitro reductions



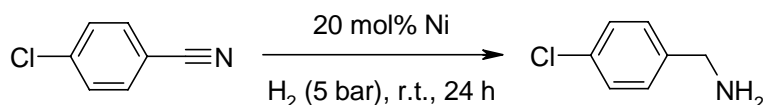
#### Reduced Catalyst Loading

Catalyst (mol%)	Time (mins)	% Conversion
NiEnCat™ (20)	240	100
NiEnCat™ (10)	240	100
NiEnCat™ (5)	240	100

#### Catalyst Recycling (5 mol%)

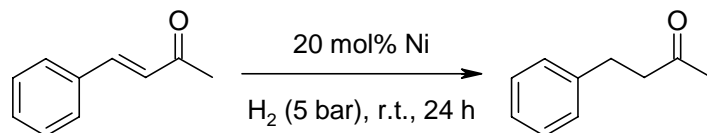
Cycle	Time (h)	% Conversion
1	16	100
2	16	100
3	16	100

### Nitrile reductions



Activated Ni EnCat (0.26 g, water wet, 20 mol% Ni on substrate) was washed with MeOH three times to remove water and added to 4-chlorobenzonitrile (0.137 g, 1 mmol) dissolved in 7 N ammonia in MeOH (4 ml) in a pressure vessel. The vessel was sealed, purged twice with hydrogen then pressurised to 5 bar with hydrogen and the contents stirred at room temperature. After 24 h the hydrogen was vented and the Ni EnCat beads removed by filtration. The filtrate was concentrated on a rotary evaporator to give 4-chlorobenzylamine (0.13 g, 91 %). GCMS purity 87 %.

### Alkene reductions



Activated Ni EnCat (0.26 g, water wet, 20 mol% Ni on substrate) was washed with MeOH three times to remove water and added to benzalacetone (0.148 g, 1 mmol) dissolved in MeOH (4 ml) in a pressure vessel. The vessel was sealed and purged twice with hydrogen then pressurised to 5 – 6 bar with hydrogen and the contents stirred at room temperature. After 24 h the hydrogen was vented and the Ni EnCat beads removed by filtration. The filtrate was concentrated on a rotary evaporator to give 4-phenylbutanone (0.149 g, 99 %). GCMS purity 88 %.

Nickel EnCat™ samples can be provided for customer trials with up to 20% by weight nickel content and have a typical bead size of between 150 and 350 microns.

Feedback from these initial customer trials will be used to optimise the EnCat™ properties, such as metal loading, polymer pore size and nickel catalyst activity, in preparation for commercial launch of the Ni EnCat™ products later in the year.

