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Design, development and demonstration of a tail-end acetylene hydrogenation catalyst

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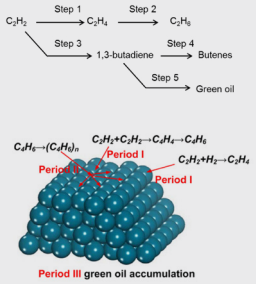
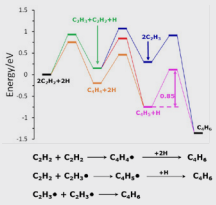
Catalyst design and conception: understanding the fundamentals

- Molecular models used for predictive simulation with the aim of increasing ethylene selectivity and lowering hydrocarbon coupling reactions.
- Evaluate the effect of bimetallic formulations and the morphology of palladium clusters on catalyst performance.1
- Develop understanding of fundamental properties of the catalysis and the deactivation routes.2



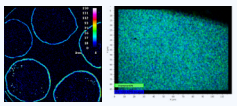
Molecular modelling of palladium crystallites, determining the oligermisation pathway for the formation of green oils.



Assessment of different pathways for the coupling of acetylene molecules

Development of selective hydrogenation catalysts

- Guided by molecular modelling a range of optimised catalysts, **PRICAT**™ PD series, has been developed with tight palladium egg-shells and uniform promoter distributions to provide highly active and selective catalysts for olefin purification applications.
- Significant investment in a range of in-house testing equipment to allow qualification and verification of molecular models, early stage catalyst development, and demonstration of optimised formulations.
- Catalyst design supported by world class analytical facilities to characterise active sites and catalyst composition.
- Investment in state-of-the-art catalyst manufacturing facility constructed for advanced catalyst formulation production.



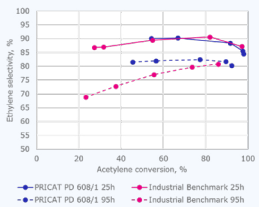
Examples of advanced characterization techniques (EPMA and XPS)

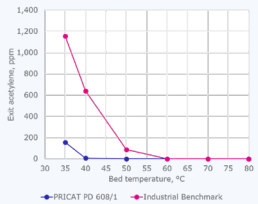
Olefin purification test rig

PRICAT and HTC catalysts

Demonstrating our customer value proposition

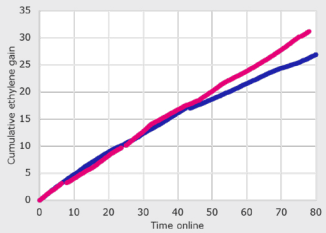
- PRICAT PD 608/1 developed for tail-end acetylene hydrogenation units.
- Catalyst has been demonstrated to have higher activity and selectivity, and lower rates of deactivation, than the industrial benchmark.
- Laboratory scale testing used in customer test programmes to demonstrate the value adding benefits of JM catalysts and de-risk catalyst selection process.
- Fundamental understanding of the catalysis, obtained in early stages of the development, has led to a market leading product with predictable behavior in duty.





Industrial application of the technology

- Industrial operating reference from three-bed system. Two-bed system awaiting start-up.
- Successful start-up and stable operation achieved with minimal green oil make.
- Catalyst responds well to changes in feed and operating parameters whilst maintaining the required acetylene exit specification.
- Collaborative relationship developed between operating plant and JM to optimise and improve catalyst performance, resulting in improvements cycle upon cycle.
- 19% increase in ethylene gain achieved between cycles, despite more challenging process conditions.



References
[1]Yang,B.,Burch,R.,Hardacre,C.,Headdock,G.,Hu,P.,J. Catal., 305, 264-276.
[2]Yang,B.,Burch,R.,Hardacre,C.,Hu,P.,Hughes,P.,J. Phys. Chem. C, 118, 1560-1567.
[3]Ahn,I.,Lee,J.,Kum,S.,Moon,S.,Catal. Today, 123, 151-157