



Phosphonics

Maximising Potential Returns

How to reduce waste and recover more precious metals
using the smartest silica technology

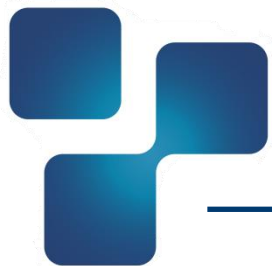
Dr. Sophie Purser: Business Development Manager



PhosphonicS Overview

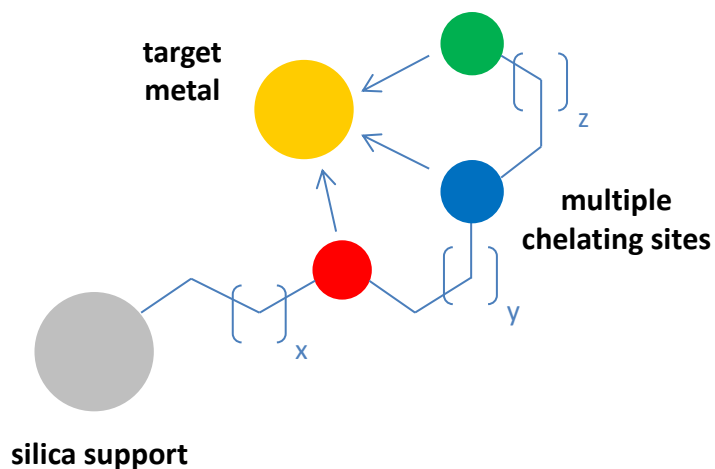
- headquarters and R+D facility near Oxford, UK
- manufacturing sites in Europe and Asia
- worldwide sales network with customers in over 25 countries





The Smartest Silica Technology

- PhosphonicS scavengers are unique silica-based products, surface-coated with multifunctional ligands



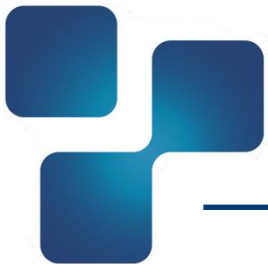
pre-scavenging



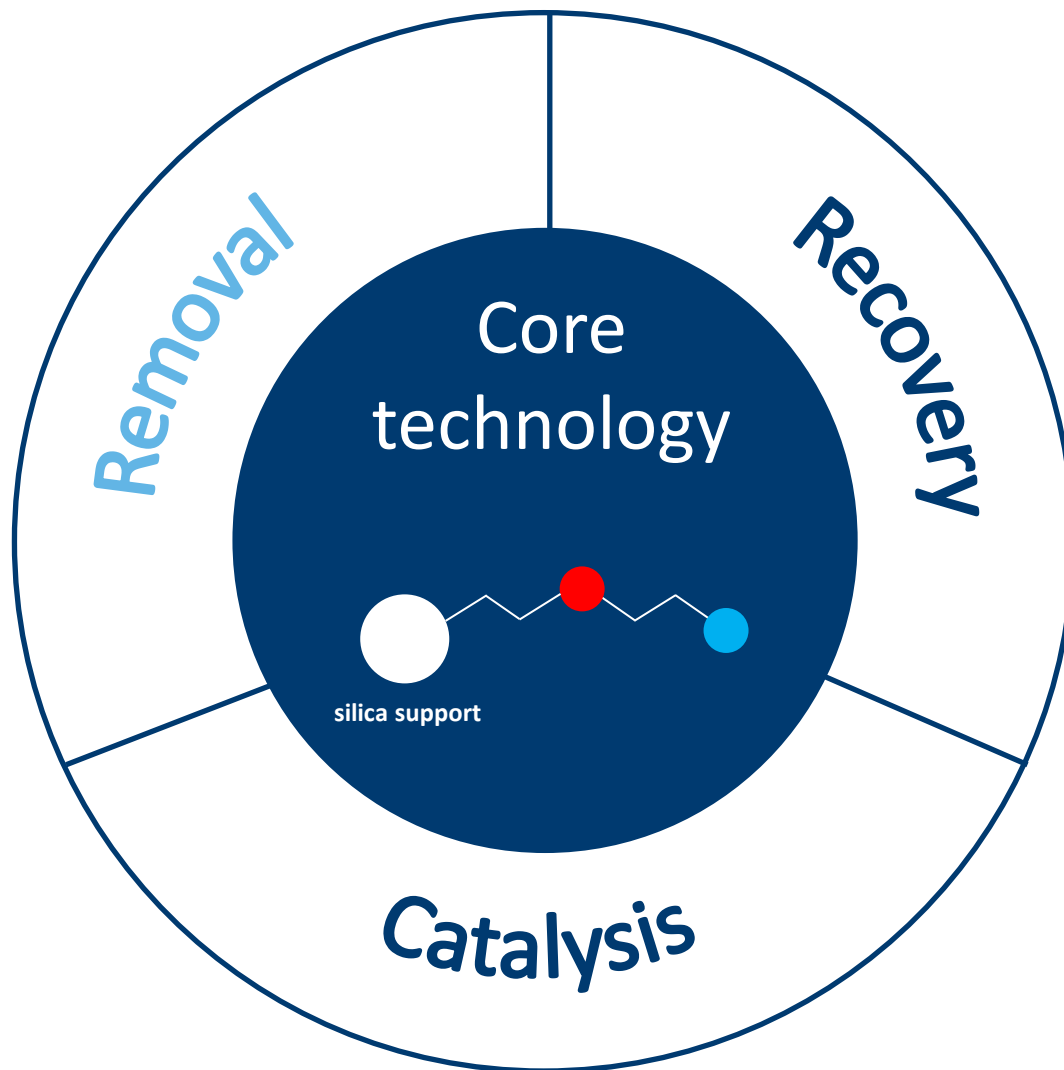
post-scavenging

- no pre-treatment of scavenger or stream
- applied as batch (slurry) or as continuous (fixed-bed) process





Core Technology & Products

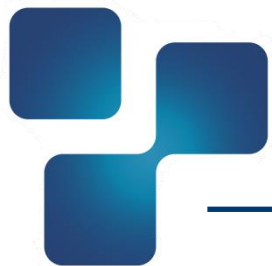




PhosphonicS Removal Products

- industry leading metal scavengers for purification
- highly selective
- broad based operating conditions
- wide range of solvents
- experience from lab scale through to full production
- minimal leaching





Life Cycle Analysis-Pd Removal

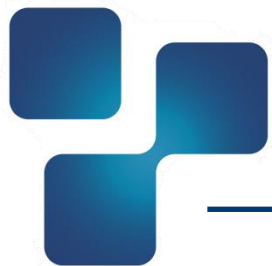
comparison of batch adsorption using activated carbon to fixed-bed continuous processing using a scavenger

- 4.9 tons of API processed
- activated carbon binds API resulting in product loss
- scavenger binds only Pd-no loss of API
- 1 batch in 20 is free using scavenger
- 94% reduction in CO₂ emissions and energy
- 62% reduction in operating costs

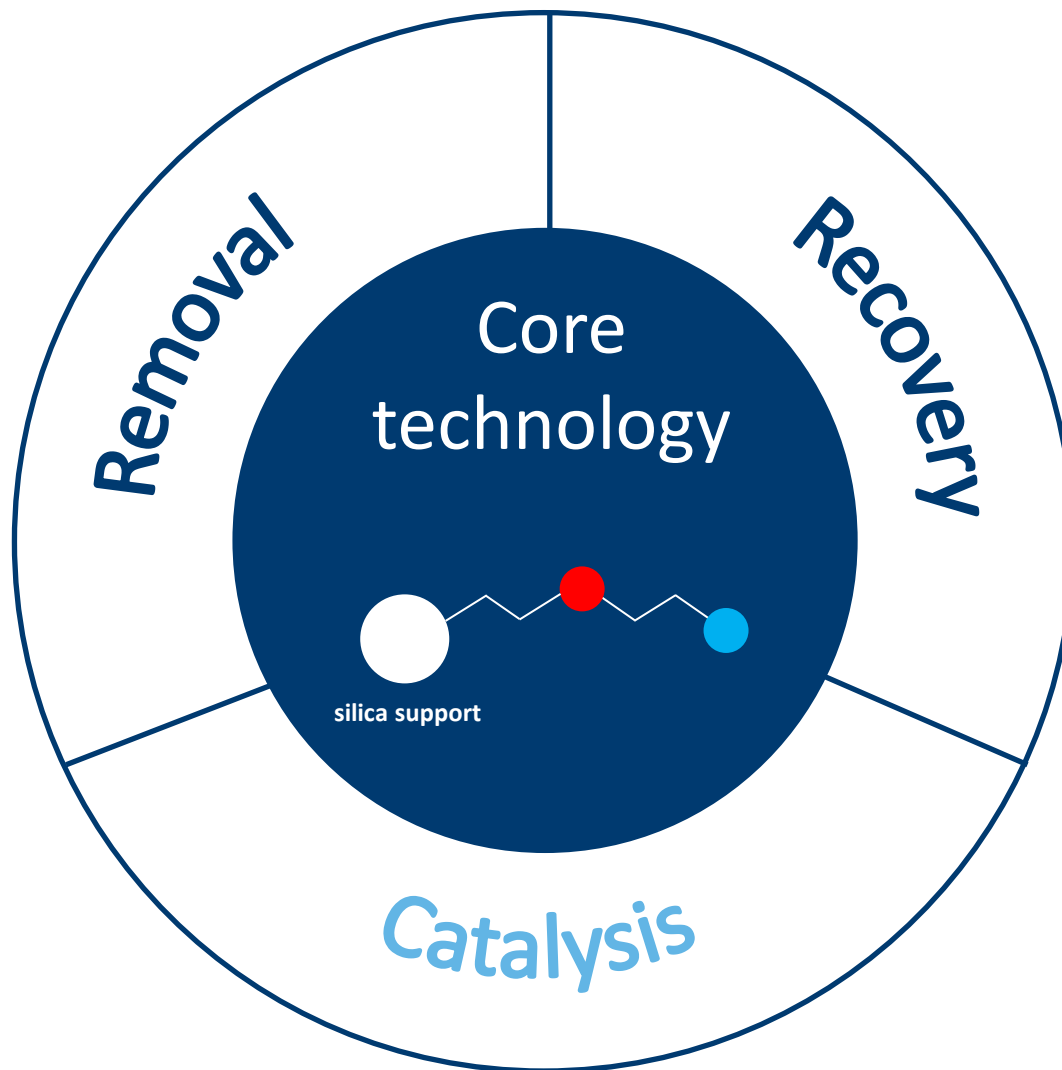
Reagent	Batch (kg)	Column (kg)	Reduction (kg)	Reduction (%)
SM1	7,357	7,021	336	5
SM2	3,534	3,373	161	5
reagent	7,599	7,252	347	5
catalyst	44.6	42.6	2	4
ligand	242	231	11	5
solvent	18,780	17,920	857	5
water	200,500	40,110	160,400	80
methanol	31,850	0	31,850	100

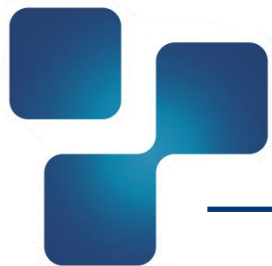
J. Enviro Science and Health **2013**, 48, 1602–1608





Core Technology & Products





PhosphonicS Catalysts

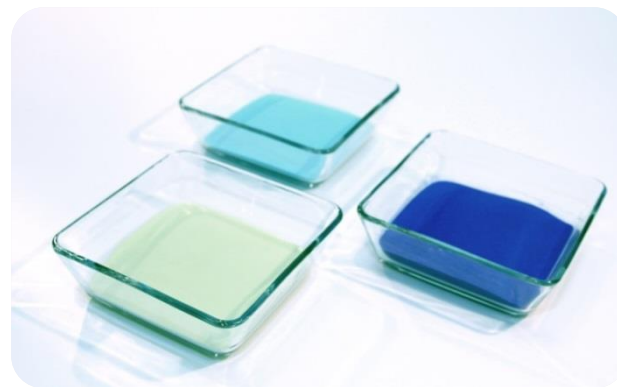
Immobilised acid catalysts

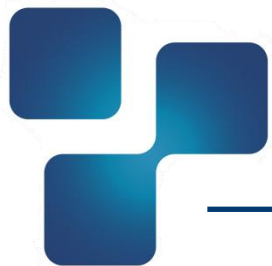
- high acid strengths comparable to traditional acids
- higher physical and chemical stability
- reduced production costs



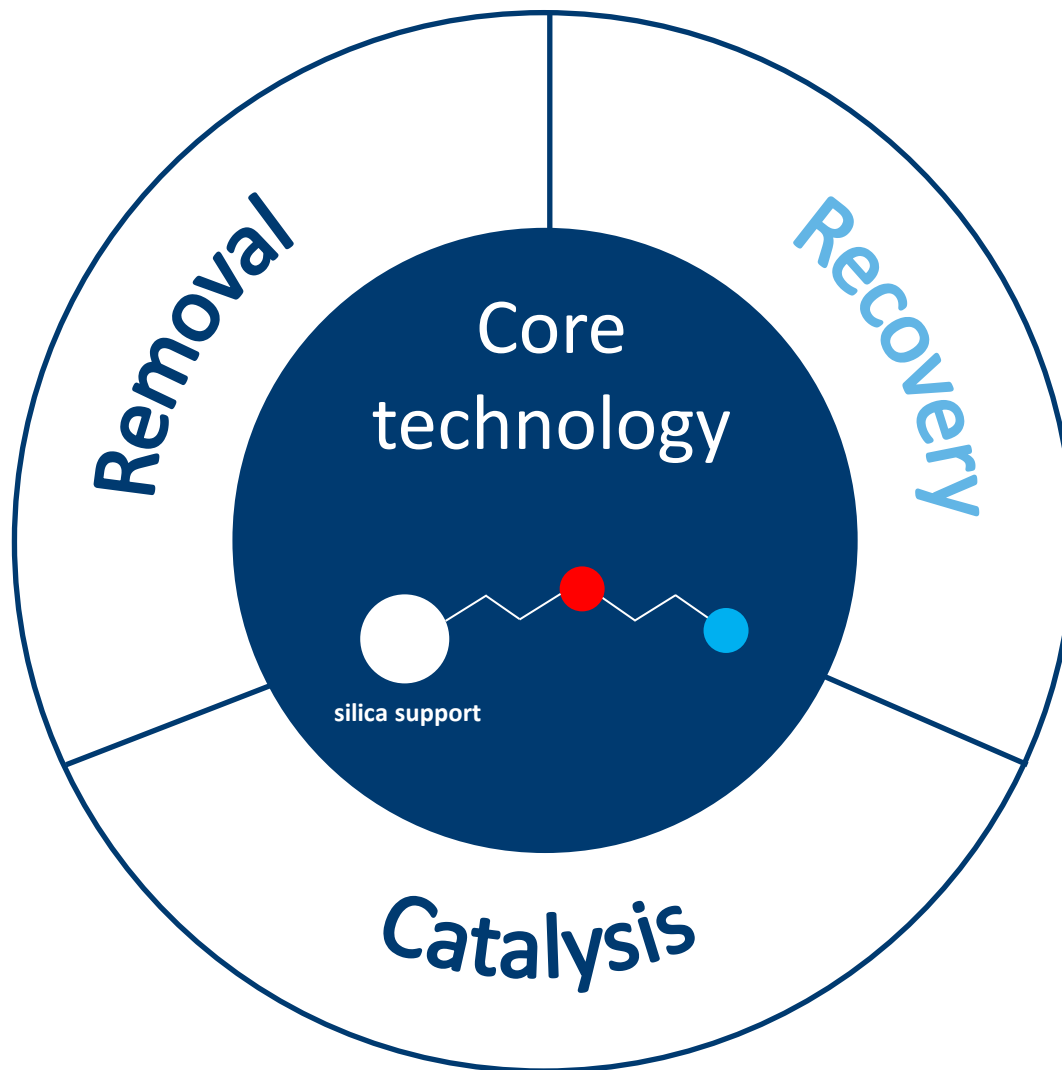
Custom synthesis

- custom design of novel immobilised catalysts
- synthesis, scale-up and manufacture to your specification





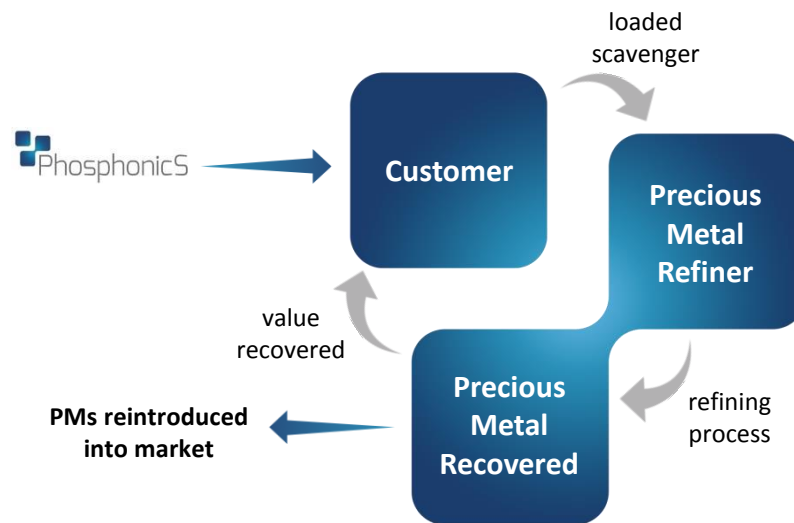
Core Technology & Products

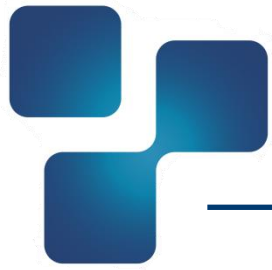




PhosphonicS Recovery Products

- designed only to recover precious metals
- superior recovery performance; 2-8% loadings
- higher PGM refining yields

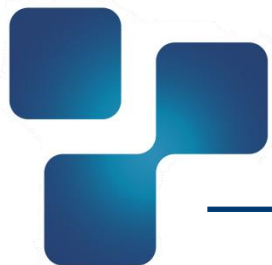




PhosponicS Test Kits

- separate recovery, removal and acid catalyst test kits available
- up to six, 10 g samples in each
- scavenger calculator and usage guide included with each kit
- guidance and help provided through test process if necessary





PhASE Programme

Screening

Optimisation

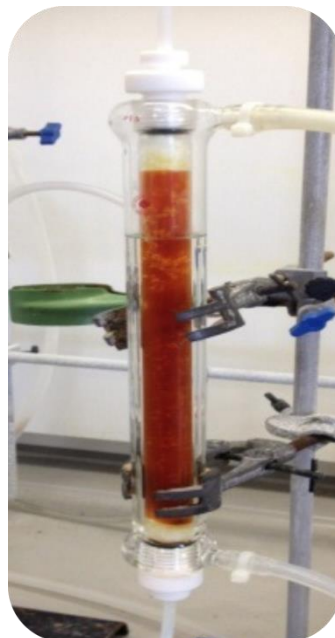
Lab-scale
cartridge

Implementation



screening + optimisation

laboratories in the
UK and China

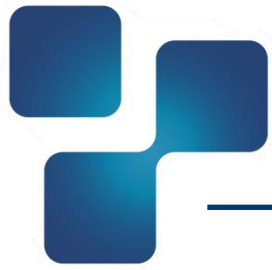


lab-scale cartridge



implementation





The Falcon™

**scavenger
cartridge**



plinth & controls

- easy to use 'plug + play' unit
- available for purchase or rental
- accelerates evaluation of technology
- generates reliable data to assess business case

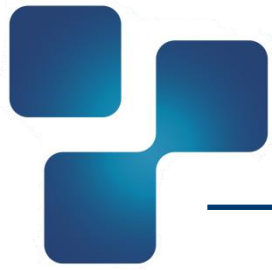


A Range of Engineering Solutions



- working theoretical model for column sizing based on laboratory tests
- standardized approach to scavenger handling depending on scale and stream tenor
- heat transfer and preheat calculations
- mechanical design, P&IDs and drafting
- manufacture by PhosponicS or customer





Our Technology Services

- R&D services available for synthesis of functionalised silica for custom applications
- advice on product usage and optimisation; through PhASE programme or test kit
- scale up support from engineering consultancy to equipment specification and supply





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Thank you for your attention!

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