

## Smectitic clays as clean and cost effective heterogeneous catalysts



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### Abstract

As the World shifts to a greener more sustainable future, processes and reagents the chemical industry have depended upon for years are increasingly under greater scrutiny. One approach to the challenge of finding better ways of producing the same quality is to look to past catalyst technologies that have fallen out of favor in recent years. Clay, more specifically montmorillonite, based catalysts have been used for many years as clean, cost effective solid Lewis or Brønsted acid catalysts. At low moisture contents, the ionising effect of the charged calcium montmorillonite surfaces can generate Hammett acidities of -3. Acid activation can push the Hammett acidities to as low as -8 as well as open up potent  $\text{Al}^{3+}$  and  $\text{Fe}^{3+}$  Lewis acid sites. Said acidified montmorillonites have been reported as being excellent catalysts for a range of reactions, including but not limited to: Friedel-Crafts alkylation, esterification, dehydration, siloxane equilibration and Diels-Alder cyclo-addition. In addition to their inherent catalytic properties smectitic clays have the potential to be used as supports for reactive ionic or crystalline metal centres through such preparative techniques as intercalation, pillaring or reductive seeding of metal nano-particles.

In this presentation we will firstly detail the performance of FULCAT<sup>®</sup> acid activated clay catalysts in Friedel-Crafts nonylation of diphenylamine (DPA), polymerisation of cyclic siloxanes and esterification reactions. These reactions were chosen due to their commercial importance. In the final part of the poster we briefly explore the opportunities for synthetic clays as scaffolds for metal nano-particles.

### Biography:

Oscar Kelly completed his PhD in the thermo reversible gelation of aqueous cellulose ethers from the University of Sheffield. He then worked for three years as a research scientist at FUJIFILM (Manchester, UK) developing polymeric dispersants for pigments. Since he has been working at BYK Additives Ltd. (Widnes, UK), firstly as a development chemist in the R&D department overseeing projects to produce new synthetic inorganic additives and acid activated montmorillonite clay catalysts. More recently he has been working as the End Use Clay Catalyst Lab Manager application testing clay catalysts in different reactions and developing new business.

### Speaker Publication:

1. "Interplay between Gelation and Phase Separation in Aqueous Solutions of Methylcellulose and Hydroxy propyl methyl cellulose" Journal of Laugmor, vol-28, Issue-28, 10551–10557; June 13, 2012.

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