

Guest Editorial

New catalysts for old problems

In a highlight from the year 2001 in "Chemistry in Britain", David Thompson predicted "A Golden Future for Catalysis" and argued that the recent research demonstrates new practical uses for gold in catalysis. After the discovery of the (sometimes surprisingly) high catalytic activity of gold, expectations were indeed very high that new industrial processes using gold catalysts would start popping up like mushrooms. This, however, has clearly not been the case up to now in chemical processing, and I am often asked the question "*why are there no new chemical processes utilizing our fantastic gold catalysts?*"

The answer to this question is not straightforward, because the development of new chemical processes is not only technology driven, but also market driven. Let us for the sake of argument imagine a chemical product and allow me to name it "Dhahabu" (if this sounds like Kisuaheli to you – you might be right!). The established process for the production of "Dhahabu" has been in use for many years, the market shows only a modest growth and the existing production plants are more or less fully depreciated. Now, imagine that a new process for the production of "Dhahabu" using a contemporary gold catalyst finds its way into the literature. A benchmark quickly shows that the new process is more economic than the old one – maybe even more environmentally benign – but still nothing happens. Why is this?



One of the main reasons is that most new developments are not so radical (as claimed to be) to achieve shut-down economics. What does this exactly mean? If the total costs of production with the new process – including costs of raw materials, energy, depreciation and return on investment – are below the cash costs of the old process, then the new process achieves shut-down economics – so it will be immediately more profitable to just shut down the old plant and build a new one using our new "Dhahabu"-process. If you have found such a new process then you are a very, very lucky guy and you should seriously consider playing the lottery. If a new process achieves shut-down economics, this simply means that by building a new plant you can out-strip your competitors. However, the very few examples I know of, where new developments have achieved shut-down economics, have always involved much more than just new catalyst developments and were always coupled with other drastic changes such as a raw material shift.

So, what if your newly developed process for the production of "Dhahabu" is good, but not good enough to achieve shut-down economics? Then you will have to put your hopes on market growth. But then – once again – the chances of a new process are driven by the relation between market growth and the standard plant size for "Dhahabu". If typical plant sizes are big compared to the market growth, then new plants are only seldom built and producers are usually able to meet the growing demand by debottlenecking existing plants and running them until they literally fall apart. Only if plant sizes are relatively small, meaning that new plants are built every few years, there is a good chance for a new process to enter the market rather quickly. But even in this case "rather quickly" means several years – quite long on the academic time scale.

The quickest way to implement a new development is, if you happen to find a better catalyst that can be used in existing plants. This has indeed already happened with gold catalysts: the newest generation of catalysts for the vinyl acetate production contain gold as one of the active metals.

Many other chemical processes are currently under investigation, so it will be just a matter of time until more gold catalyzed chemical processes come into use and other fields of use are also making great progress. Innovation in chemical industry simply takes its time, but when it finally comes it's usually around for a long time.

The ever increasing participation in the GOLD conferences is a clear proof that catalysis with gold is really a hot-topic. So don't forget to bookmark the GOLD 2009 conference in Heidelberg in your calendar. This will be the place to meet the community and get fresh ideas for new gold catalyzed reactions!

Henrique Teles

BASF SE, Ludwigshafen am Rhein, Germany

Editor's note:

Dr Teles is a member of the GOLD 2009 Organising committee