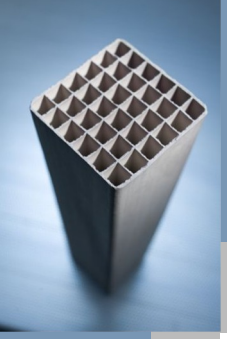

Project Newsletter No. 2

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Universität Stuttgart - EnBW Kraftwerke AG - E.ON New Build & Technology GmbH - ENEL Ingegneria e Innovazione S.p.A - Frauenthal GmbH - RECOM Services GmbH

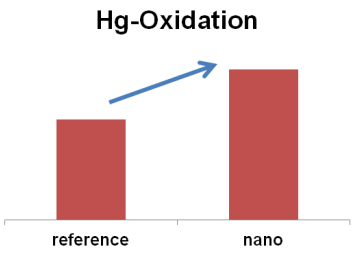
Headlines:

- Over 25 new catalysts produced
- Nano-Material catalysts successfully produced
- Screening of catalysts show promising results
- Regeneration extensively studied in laboratory
- Small-scale test rig successfully constructed
- Two full-scale catalyst modules with newly developed catalysts installed
- Measurements in two full-scale power plants performed
- First parameters for mercury retention in lab-scale wet FGD identified
- 3D-CFD model improved

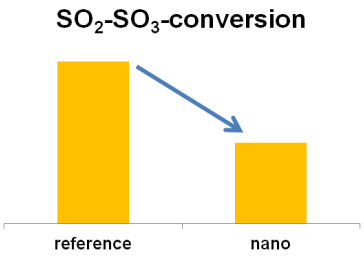
In detail:

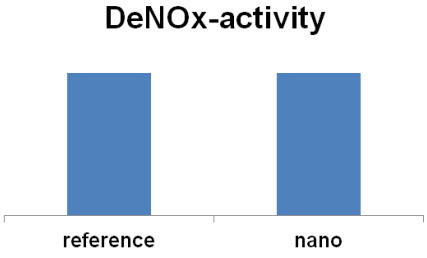
Catalyst production:
During the last months, Porzellanfabrik Frauenthal produced over 25 new catalyst. Some of these catalysts were produced as full scale monoliths and some in a lab-scale size. The catalysts distinguish in their geometrical parameters. The research & development department of Porzellanfabrik Frauenthal did also a great job in producing the first catalysts with nano-particles. Over five nano-catalysts are available right now.

set of newly developed catalysts



Screening of catalysts:
Newly developed catalysts were evaluated in extensive tests in bench reactors as well as micro-reactors. In these test, DeNOx-activity, mercury oxidation and SO_2/SO_3-conversion were determined. The general trend shown in previous research, that high mercury oxidation can only be achieved with an undesired high SO_2/SO_3-conversion could be resolved. Some newly developed catalysts show significantly higher mercury oxidation at a great DeNOx-activity and reduced SO_2/SO_3-conversion.
Further research on the interaction of the reactions at the catalyst will be done within the next months





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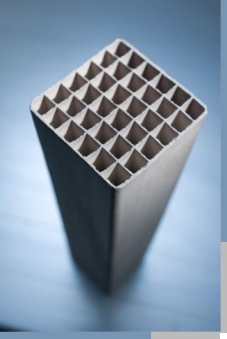

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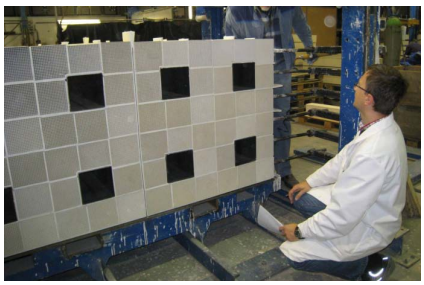
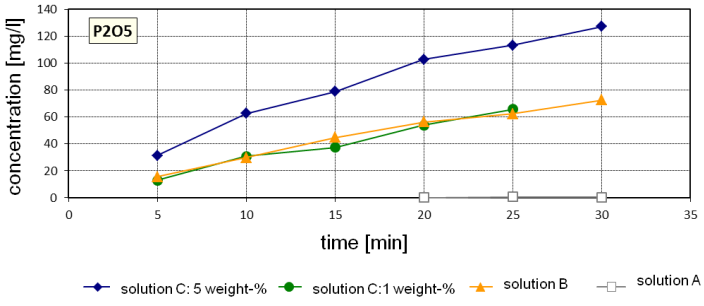
In detail (continued):

Test modules installed:
Catalyst development within DEVCAT is not only limited to laboratory. The most promising catalysts are also tested in different full-scale power plants for their longtime-behaviour. The first module packed with monoliths of newly developed catalysts as well as commercial reference catalysts for comparison was installed in Maasvlakte power station (Belgium) by the end of 2011. In this power station various fuels are co-fired additional to coal. The second module was installed in the coal-fired CHP Altbach (Germany) in spring 2012.



assembling of the full-scale module



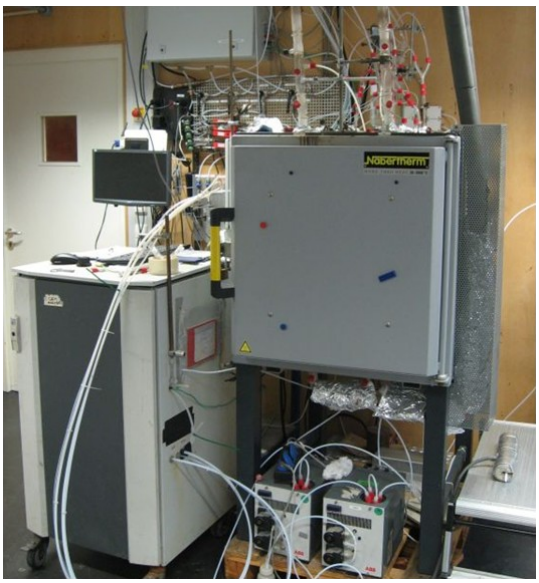
Regeneration tests:
Integration of renewable energy sources causes an increased amount of start ups and shut downs at coal fired power plants resulting in a faster deactivation of the catalyst.
Catalyst regeneration is a possibility to increase the lifetime of deactivated catalysts.
Extensive studies on catalyst regeneration have been performed in laboratory scale and the removal of catalyst poison of heavily deactivated catalysts have been studied.

Equipment applied (1):

Starting now, this series will explain the equipment applied within the project.

The laboratory micro reactor:
The smallest reactor in which catalyst tests are performed within DEVCAT is the micro reactor. Micro reactors are standardized test reactors according to the VGB Guideline VGB-R 302H. The reactors are constructed out of glass in order to avoid interaction of the synthetic flue gas components with the reactor. The relevant gases like nitrogen oxide, sulphur dioxide, ammonia as well as mercury are dosed in the reactor and mixed properly before entering the catalyst. The concentration of the components are measured by on-line analyzers or by standardized wet chemical methods.

Catalyst screening:
In the beginning of the project, test conditions (concentrations, temperatures, gas mixtures) for screening of the catalysts were fixed between the partners. DeNOx-activity, mercury oxidation and SO_2/SO_3-conversion of all catalysts developed within the project were measured at these conditions and the results compared. Also the success of the laboratory regeneration procedures was observed by measurements in the micro reactor.



Laboratory micro reactor operated at USTUTT (right) with continuous mercury analyzer installed in an air conditioned cabinet (left)

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