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Zirconium based catalytic units for tars cracking

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Introduction

Zirconium oxide and doped zirconium oxide find uses in many different types of environmental and chemical catalysis applications. The success of this material is due to an ability to modify physical and chemical properties by subtle processing methods and the incorporation of other dopants, thereby fine-tuning the critical parameters of a catalyst support. Different combinations of properties are required for different applications, but having high thermally stable surface area and porosity are pre-requisites for all catalyst applications.[1] In this poster, catalytic purification of biomass gasification gas in integrated gasification combined cycle power plants, is invesigated.[2,3]

Objective

To produce metal based catalytic units with:

- Steel strip thicknesses of 30-50 microns;
- Honeycomb structures with internal channels from 2 to 12 mm^2 in cross section;
- Zirconium oxide coatings which exibit high adhesion to metal substrates and also retain high specific surface areas when deposited on internal surfaces of honeycomb structures;
- Zirconium oxide coatings which can be promoted with active components by impregnation, slurry deposition etc.

Results

The technology for producing metal based honeycomb units with zirconium oxide coatings has been developed and includes the following 3 steps:

- Materials preparation, including
  a) precursor materials synthesis for thermal spraying,
  b) steel strip cleaning;
- Thermal spraying;
- Mechanical treatment, including the processes of cutting, corrugation and assembly of the unit, plus its fastening. (Figure. 1).

The zirconium oxide coating shows excellent adhesion to the steel substrate, no depletion or peeling appears during mechanical treatment and a high specific surface area of≈100m^2/g is retained. This is higher than the typical surface area after calcination of the zirconium powder at 800°C. (Figure. 3).

Zirconium oxide coating (ZrHTC) was promoted with Ni catalyst (Ni/ZrHTC) and the activity of both samples is shown (Figure. 4).

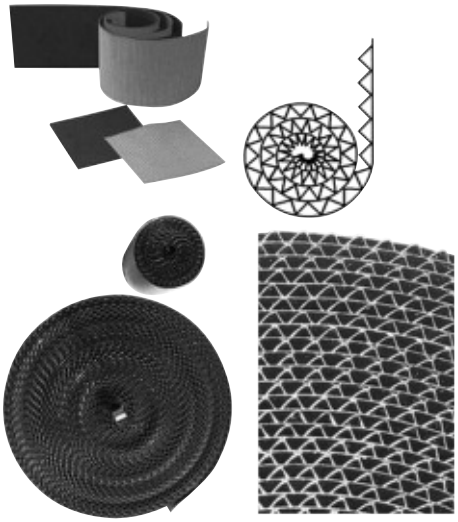

Figure 1: Structure of catalytic elements.

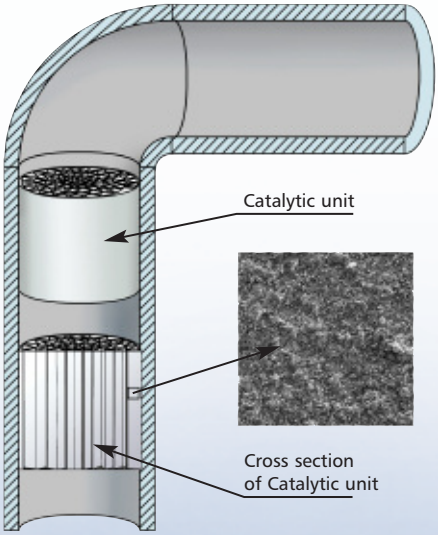

Figure 2: Evolving opportunities.

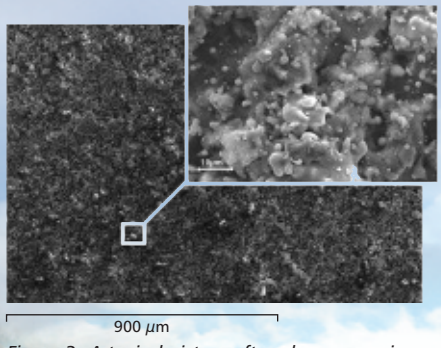

Figure 3: A typical picture after plasma spraying.

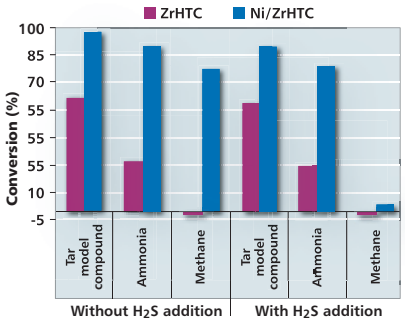

Figure 4: The results of the activity testing at 900°C with and without H_2S in the feed.

Conclusions

Complex zirconia based supports were produced by plasma spraying a steel strip with zirconium based hydroxides.

These metallic catalytic units have given rise to new ideas regarding local tar decomposition, according to which, catalytic elements could easily be installed into critical places of gasification plants (Figure 2), lowering the loading on the existing tar decomposition units and increasing admissible levels of tar concentration.

Samples

- Samples of the various zirconium hydroxide products mentioned are available, and in most cases have been produced commercially on tonnage scales. For further information please contact melchemsales@melchemicals.com
- Honeycomb structure catalytic elements with zirconium based coating on metal substrate are available, for these samples or future information please contact: info@amiagus.com

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