The Study of The Prepared Catalysts in DeNOx Reaction

1. **Aim of the experiment:**
   The aim of this work is to familiarize with the experimental set-up used for SCR of NOx by ammonia and to study activity and selectivity of the prepared catalysts in the mentioned reaction.
2. **Introduction**
   The combustion of fossil fuels and biomass result in large emissions of pollutants into the environment. The pollutants such as nitrogen oxides (NOx) have very negative effect on the environment – the formation of acid rains, global warming and/or the deterioration of the ozone layer. To limit NOx emissions SCR method is used on a large scale: catalytic reduction of NOx with NH3 for emissions from stationary sources.
3. **Nitrogen oxides:**
   In the combustion of fossil fuels and biomass mainly NO (95%) is produced. NO together with NO_2, which is also formed in this process, are marked as NOx. There are three types of NOx which are formed in boilers:
   - Thermal NOx – they are formed in the reaction of atmospheric oxygen and nitrogen at high temperatures
   - Fuel NOx – they are formed in the combustion of organic compounds which have nitrogen in their structure
   - Fast NOx – they are formed when organic compounds react with atmospheric nitrogen, and then the products of that reaction are combusted
4. **Selective Catalytic Reduction**:
   - Desired Reaction :

$4\ NO + 4\ NH_3 + O_2 = 4\ N_2 + 6\ H_2O$

$4\ NO_2 + 4\ NH_3 + O_2 = 3\ N_2 + 6\ H_2O$

   - Undesired Reaction:

$4\ NH_3 + 5\ O_2 = 4\ NO + 6\ H_2O$

$4\ NH_3 + 3\ O_2 = 2\ N_2 + 6\ H_2O$

$2\ NH_3 + 2\ O_2 = N_2O + 3\ H_2O$

5. **Experimental set-up**

Experimental set-up for SCR consists from following elements: several containers with appropriate gases, flow controllers and a reactor which is placed in a furnace connected with temperature programmer. Gas which leaves the reactor comes through washer with 30% phosphoric acid (absorption of ammonia), the dryer with silica gel (adsorption of water vapor), the NO_2 to NOx converter, the gas analyzer and the calibration burette. The used gas analyzer of NDRI type analyses absorption of infrared radiation and compares its spectra with the spectra of the reference gas.

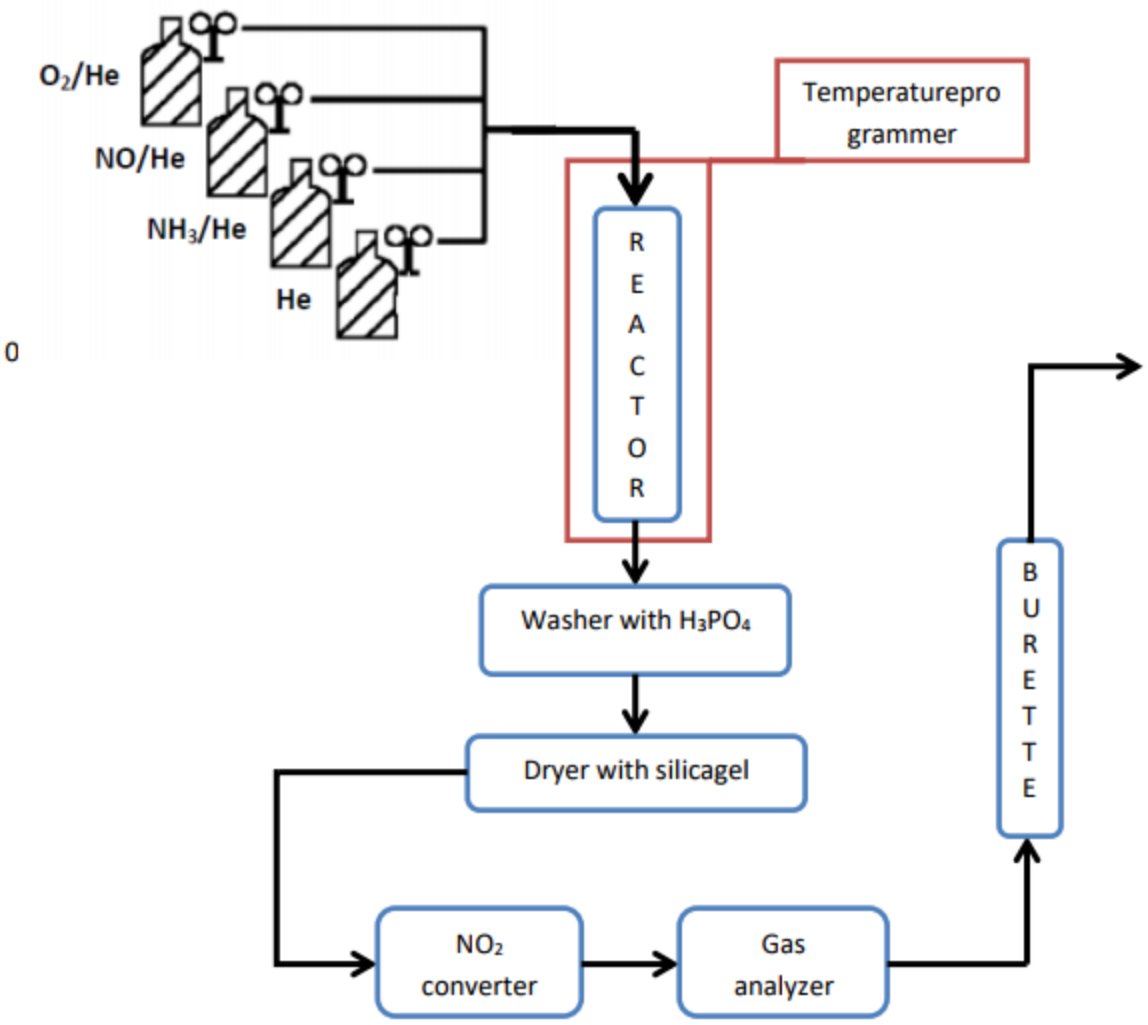

Figure 2 The schematic representation of experimental set-up

6. Catalyst Preparation:
   - Acidic treatment of Activated Carbon
   - Introduction of N group
   - Active Phase deposition
7. What Characterize Good Catalyst:
   - High activity
   - High Selectivity
   - Good life time
   - The ease of regeneration
8. Activity:
   The parameter which determine at which extent the reaction is accelerated
   It is measured by calculating the conversion under the same conditions (Mass of catalyst, pressure, flow rate)

NO conversion was calculated according to the equation: NO conversion $=\frac{NO\ in - NO\ out}{NO\ in}$ *100% (where NOin is the inlet NO concentration, NOout is the outlet NO concentration).