Innovation City Bottrop

NOx degradation through photocatalytic surfaces

Air pollution from nitrogen oxide (NO) and nitrogen dioxide (NO_2) has become one of the largest air quality problems in urban areas, with many cities worldwide exceeding recommended concentration limits. Except for removing traffic with combustion engines, there are very few options to reduce NO and NO_2 pollutants in urban areas. This project investigated the effects of photocatalytic surfaces on the local pollutant level.

One of the passive strategies to lower NO, NO_2 and subsequent near-surface ozone in urban areas is the use of photocatalytic active surfaces. These surfaces, containing titanium dioxide in the materials or paint, are able to absorb NO and NO_2 from the air and transform it into a solid nitrate which can be washed away with the rain. The effect of this pollutant removal on local air quality was investigated using the ENVI-met passive and active chemistry model that includes the NO-NO_2-ozone reaction cycle.

The Innovation City Bottrop Project was a large think tank and demonstration project in the Ruhr area with STEAG Power Minerals and TU Berlin. The ENVI-met team investigated the potential of using photocatalytic surfaces (ground surface and facades) to reduce the NO and NO_2 levels. Several simulations were performed for the inner-city district of Bottrop using different meteorological scenarios and varying levels of active surfaces initially using the PHOTOMENT material from STEAG Power Minerals. In later project phases, different materials using KRONOS titanium dioxide were investigated.

The results of the ENVI-met simulations showed a local reduction of 5 % to 14 % NO and 4 % to 6 % NO_2 could be achieved using this passive technology, depending on the level of active surfaces and of the traffic NOx load.

FACTS

Clients
STEAG Power Minerals, Dinslaken, Germany
KRONOS International, Leverkusen, Germany

Implementation period
First phase 2013, several following phases

Used Features
ENVI-met pollutant dispersion model; active chemistry model