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Report on the laboratory tests on surface transformation and atmospheric chemical reactions

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Research Report Summary

TiO_2 and CeO_2 are among the most produced engineered nanomaterials (ENM). TiO_2 is often used because of its known photocatalytic properties, whereas CeO_2 is used as a diesel fuel additive. TiO_2 can for example photocatalytically reduce NO_2 to NO (see Figure 1). Ambient NO_2 stems mainly from combustion processes in traffic and industry and can be harmful to human health upon inhalation. The aim of the work presented here was to study the effect of TiO_2 and CeO_2 released into the atmosphere on atmospheric NO_2 concentrations under UV exposure. The outcome shall be used in the multimedia model in NanoFASE for the atmospheric compartment. Our results show that the reaction of TiO_2 with NO_2 is a function of the TiO_2 concentrations as well as the UV exposure. At high particle concentrations, the reduction of the NO_2 concentration was nearly independent of the UV exposure. On the other hand, for high UV exposure, the effect of the TiO_2 concentration is very small. Most importantly, TiO_2 only showed a noticeable effect on the NO_2 concentrations at TiO_2 particle concentrations $>5 \times 10^5$ #/cm³, which are very unlikely in the atmosphere, except for locations near the particle release. The effect of CeO_2 ENM on atmospheric NO2 concentrations was found to be negligibly small. In summary, it can be expected that the effect of TiO_2 and CeO_2 on ambient NO_2 concentrations can be expected to be generally very small if not negligible due to too low ambient concentrations of TiO_2 and CeO_2 nanomaterials.

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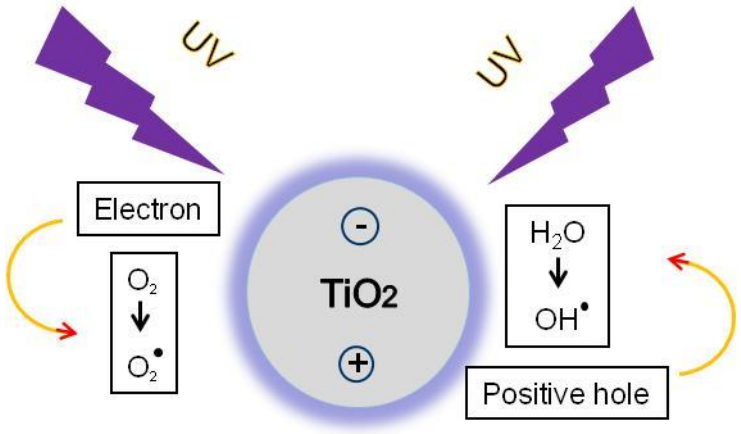

Figure 1: Mechanism of photocatalytic reaction with TiO_2 particles

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