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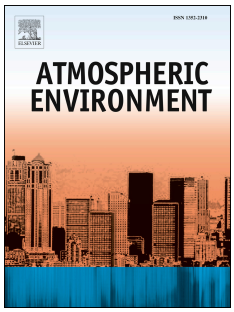

Photoactive roadways: Determination of CO, NO and VOC uptake coefficients and photolabile side product yields on TiO_2 treated asphalt and concrete

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Photoactive Roadways: Determination of CO, NO and VOC Uptake Coefficients and Photolabile Side Product Yields on TiO_2 Treated Asphalt and Concrete.

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ABSTRACT

This work reports uptake coefficients and by-product yields of ozone precursors onto two photocatalytic paving materials (asphalt and concrete) treated with a commercial TiO_2 surface application product. The experimental approach used a continuously stirred tank reactor (CSTR) and allowed for testing large samples with the same surface morphology encountered with real urban surfaces. The measured uptake coefficient (γ_{geo}) and surface resistances are useful for parametrizing dry deposition velocities in air quality model evaluation of the impact of photoactive surfaces on urban air chemistry. At 46% relative humidity, the surface resistance to NO uptake was ~ 1 s cm^{-1} for concrete and ~ 2 s cm^{-1} for a freshly coated older roadway asphalt sample. HONO and NO_2 were detected as side products from NO uptake to asphalt, with NO_2 molar yields on the order of 20% and HONO molar yields ranging between 14-33%. For concrete samples, the NO_2 molar yields increased with the increase of water vapor, ranging from 1% to 35% and HONO was not detected as a by-product. Uptake of monoaromatic VOCs to the asphalt sample set displayed a dependence on the compound vapor pressure, and was influenced by competitive adsorption from less volatile VOCs. Formaldehyde and acetaldehyde were detected as byproducts, with molar yields ranging from 5-32%.