International Master 2 Atmospheric Sciences: Research Training 2020-2021

Laboratory: SAGE

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CaPPA Work Package: WP2

Investigating the emissions and chemical reactivity of asphalt concrete towards key atmospheric species of different chemical families

Air pollution is one of the major issues that concern our society nowadays. The intensive human activities related to industrial production, fossil fuel burning for transportation and heating produce a variety of primary and secondary pollutants that degraded the air quality. The air quality degradation is getting more and more important in large cities (i.e. urban environments) where pollutant concentrations often exceed the limits settled by environmental protection agencies.

Although significant progresses have been performed by the scientific community along the past decades to improve our understanding about the fate of pollutants, there are still many open questions to be addressed. For instance, there is a significant lack of studies dealing with the interaction/reaction of pollutants with common surfaces existing in cities (e.g. building construction materials, asphalt concrete etc.).

Consequently, the objective of this master is to identify and quantify the emissions of asphalt concretes used for the construction of roads in urban sites, under simulated atmospheric conditions. The speciated emissions from asphalt concrete surfaces will be estimated in micro and macro scale, employing temperature regulated atmospheric simulation chambers that can mimic the real conditions existing in the atmosphere (i.e. temperature, humidity, sunlight). In addition, the impact of atmospheric oxidants (i.e. O_3, NOx, etc.) to asphalt concrete emissions, as well as the possible formation of SOA, will be investigated. State of the art instrumentation (GC-FID/MS, PTR-MS, SIFT-MS, HPLC, NOx and ozone analyzers) will be used to characterize the volatile and semi-volatile organic fraction, of nearly 100 species, of asphalt concrete emissions. The anticipated sound results will be provided to collaborators and be implemented in chemical transport models aiming to evaluate whether asphalt concrete can be an important source of organic compounds in the atmosphere and what could be the consecutive impacts on air quality of urban cities in the context of climate change.

Key words: heterogeneous reactivity, asphalt concrete, pollutants fate, NOx, O_3, VOCs