How does the chemistry at environmental interfaces affect the air quality?

Water surface microlayer (SML) is ubiquitous in the environment and provides a unique medium for interfacial chemical processing. The presence of surfactants at the SML can increase the tendency of less surface-active organic compounds to enrich at the water surface as well, thereby, creating a unique chemical medium, impacting both, the heterogeneous chemistry and the exchange of trace gases with the atmosphere.

Deposition of ozone to the ocean and freshwater is an important removal path of ozone due to the chemical reactivity at the air-water interface. The number of the product compounds increase and the nature of the organics is altered upon ozone reactions with the riverine surface microlayer. The newly formed compounds can also affect the biodiversity of the freshwater and pose environmental concern. The interfacial ozone oxidation chemistry at riverine surface microlayer generates a large fraction of nitrogen (N)-containing organic compounds released in the atmosphere, which can have an impact on human health and the environment.

Building surfaces are a boundary between the indoor and outdoor environment. Myriad of pollutants which are emitted into the air by automobiles, factories and a host of other sources present in the cities where we live, can settle on the building surfaces in form of a grime. Hence, urban grime is a mixture of organic compounds and inorganic ions coated on the building surfaces. Sunlight acting on urban grime very rapidly releases gas phase nitrogen oxides (NO) and nitrous acid (HONO) back into the atmosphere, by the light-induced heterogeneous reactions of nitrogen dioxide (NO_2) with organic compounds such as polycyclic aromatic hydrocarbons (PAHs) trapped in the grime. HONO is very important player in urban atmospheric chemistry as represents the main primary source of hydroxyl radicals (OH) in urban air. Some of the released N-containing organic compounds by this chemistry make a part of the still poorly characterized light-absorbing organic compounds known as “brown carbon” indicating the importance of heterogeneous NO_2 conversion processing on urban grime.

Natural sunlight triggers the release of organic sulfur compounds from the building surfaces through sunlight-induced heterogenous reaction of sulfur dioxide (SO_2) with the fatty acids coated on the urban grime. Organic sulfur (OS) compounds have been globally identified in ambient secondary organic aerosols (SOA), but their contribution to organic mass is not well quantified, and the current models considerably underestimate ambient SOA formation. Organic sulfur compounds are surface active and may also play a role in cloud formation.