# The interaction of water with aircraft soot and their surrogates

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The air traffic has increased of about 5%/year in the last decades, and its foreseen growth have raised environmental issues relative to air pollution in airport sites, and climate forcing due to gas and particles emissions at cruising altitudes (Masiol, 2014). Concerning this latter issue, soot aerosols impacts on climate still remain at a low level of understanding, and little is known about the aviation induced cloudiness, which includes linear contrails forming at the engines exhaust and long-living artificial cirrus formed after ice nucleation on soot particles. Those phenomena strongly depend on the ability of soot particles to nucleate ice, which is related to the shape, size, structure, elemental composition and surface chemistry, but also depends on the fuel characteristics and combustion conditions (Liati 2014, Vander Wal 2014). In this context, the "MERMOSE" project (www.mermose.onera.fr) aims at studying physical and chemical characteristics of carbonaceous particles, emitted from a SAM146 turbofan engine operated on a bench facility (Snecma) (Parent, 2016) (Fig.1).

Ice interaction, nucleation and growth have been studied by X-ray photoelectron spectroscopy and X–ray diffraction on aircraft particles and their surrogates produced by a propane diffusion burner miniCAST-5201C, and compared to graphite HOPG as a reference.

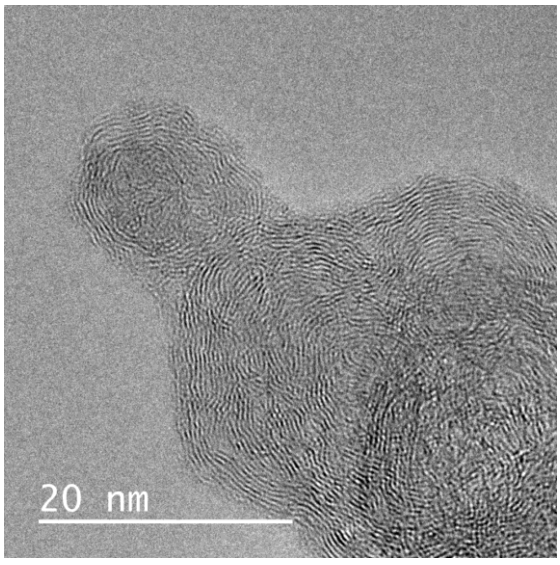


Figure 1. Carbonaceous soot emitted from SAM146 turbofan at cruise thrust regime.

We show that soot particles are readily and irreversibly oxidized when exposed to water at room temperature. Our results also point out a strong hindering of both ice nucleation and its subsequent growth by organic species present in various amounts at the surface of the studied samples (Fig.2). This study evidences the high sensitivity of ice nucleation to the chemical composition of the soot surface and the prominent influence of organic species in hygroscopic properties of soot.

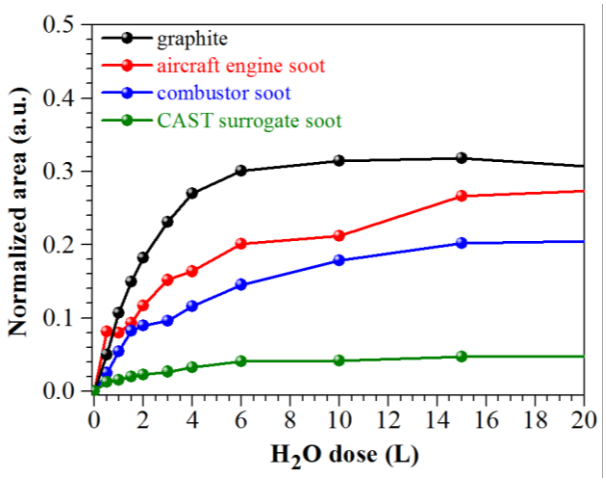


Figure 2. XPS O1s signal evolution during ice nucleation and growth at 70K onto graphite and various soot surfaces.

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