Photoenhanced deposition of trace gases at the interface of organic surfaces

CHRISTIAN GEORGE AND BARBARA D'ANNA

Université de Lyon, Lyon, F-69626, France , Université Lyon 1, Lyon, F-69626, France , CNRS, UMR5256, IRCELYON, Institut de Recherches sur la Catalyse et l'Environnement de Lyon, Villeurbanne, F-69626, France

Atmospheric aerosol particles have been found to contain moderate to high fractions by mass of organic compounds. These may be biogenic or anthropogenic in origin, depending on the location and history of the individual particle. The recent and growing awareness of this has spurred a significant effort in understanding how organic compounds on particle surfaces influence water condensation there; how this changes as the particle becomes 'processed' (i.e. oxidized) in the atmosphere, and how these processes influence the gas phase composition in volumes containing such particles. Most of these studies evaluated the uptakes or the deposition of some trace gases at the organic interface under dark conditions. However, very few investigations focus on the effect of solar irradiation on atmospheric heterogeneous chemistry, although recent findings confirm the presence of UV-A/Visible light absorbing material in airborne particles and environmental surfaces which can allow photo-induced (or photosensitized) processes.

The present work demonstrates the photo-enhanced uptake of NO_2 and O_3 on various organic surfaces as various aromatic compounds used as proxy of biogenic and anthropogenic emissions (PAHs, phenolic compounds) and humic acid coatings and submicron particles. The results suggest that photo-induced uptake can be important under atmospheric conditions with respect irradiance, humidity, temperature and gas trace mixing ratio.

Stability of complex hydrocarbons within fluid inclusions in rocks exposed to high temperatures

S.C. GEORGE[1]*, A. DUTKIEWICZ[2], H. VOLK[3], J. RIDLEY[4] AND R. BUICK[5]

[1]Macquarie University, Sydney, NSW 2109, Australia (*correspondence: Simon.George@mq.edu.au)
[2]University of Sydney, Sydney, NSW 2006 Australia
[3]CSIRO Petroleum, P.O. Box 136, North Ryde, NSW 1670, Australia
[4]Colorado State University, Fort Collins, CO 80523-1482, USA
[5]University of Washington, Seattle, WA 98195-1310, USA

Fluid inclusions (FI) form during migration of fluids through rocks. These tiny vessels are closed systems that can contain oil and gas, and are shielded from contamination and from much of the alteration that usually affects hydrocarbons over time. For example, it has been shown that oil can be preserved in FIs in Archean and Proterozoic rocks, despite heating to lower greenschist facies (280–350°C) [1, 2]. Analysis of the trapped oil and gas in Proterozoic rocks from Australia, Canada and Gabon by gas chromatography-mass spectrometry has shown the presence of CH_4, CO_2 and many hydrocarbons typical of oil including biomarkers [3–5]. Molecular maturity parameters indicate that these FI oils were generated in the oil window with no evidence of extensive thermal cracking.

Oil-to-gas cracking in crude oil reservoirs is thought to start around 160–215°C, with the upper temperature of crude oil stability around 250°C [6, 7]. Accordingly, alternative explanations for survival of inclusion oils in higher temperatures must be sought, particularly given the very long time that has elapsed since trapping of the oil. Three properties of FI oils that differentiate them from crude oil in the pore space of petroleum reservoirs are pertinent to the question of thermal stability: (1) closed systems, (2) high fluid pressures, and (3) lack of mineral or metal catalysts [8]. The relative importance of these properties will be evaluated.

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