Ideally, this abstract should be just before the oral presentation of Merlin Etzold.
Many thanks,
Julien

Abstract Submitted
for the DFD16 Meeting of
The American Physical Society

Decontamination of chemical tracers in droplets by a submerging thin film flow.[1] JULIEN R. LANDEL, DAMTP, University of Cambridge, HARRY MCEVOY, Dstl, STUART B. DALZIEL, DAMTP, University of Cambridge — We investigate the decontamination of chemical tracers contained in small viscous drops by a submerging falling film. This problem has applications in the decontamination of hazardous chemicals, following accidental releases or terrorist attacks. Toxic droplets lying on surfaces are cleaned by spraying a liquid decontaminant over the surface. The decontaminant film submerges the droplets, without detaching them, in order to neutralize toxic chemicals in the droplets. The decontamination process is controlled by advection, diffusion and reaction processes near the drop-film interface. Chemical tracers dissolve into the film flow forming a thin diffusive boundary layer at the interface. The chemical tracers are then neutralized through a reaction with a chemical decontaminant transported in the film. We assume in this work that the decontamination process occurs mainly in the film phase owing to low solubility of the decontaminant in the drop phase. We analyze the impact of the reaction time scale, assuming first-order reaction, in relation with the characteristic advection and diffusion time scales in the case of a single droplet. Using theoretical, numerical and experimental means, we find that the reaction time scale need to be significantly smaller than the characteristic time scale in the diffusive boundary layer in order to enhance noticeably the decontamination of a single toxic droplet. We discuss these results in the more general case of the decontamination of a large number of droplets.

[1]This material is based upon work supported by the Defense Threat Reduction Agency under Contract No. HDTRA1-12-D-0003-0001.

Julien Landel
DAMTP, University of Cambridge

Date submitted: 29 Jul 2016 Electronic form version 1.4