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Modelling colloidal particle deposition and resuspension from turbulent flows

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Abstract Particulate fouling generally arises from the continuous deposition of small or colloidal particles on initially clean surfaces, a process which can even lead to a complete blockage of the fluid cross-section. The complete phenomenon encompasses several sub-phenomena, such as single-particle deposition and re-entrainment as well as particle agglomeration and multilayer deposition and resuspension, back effects on fluid flows, clogging and eventually blockage. This subject is of paramount importance in a range of practical situations, from industrial plants for energy production to nanotechnologies, and raises many challenging theoretical and modelling questions. In this presentation, attention is limited to the “early stages of particle deposition” which correspond to single-particle deposition and resuspension on clean but rough surfaces. A review of experimental evidence as well as a general framework useful to address particle deposition modelling issues is first introduced. Then, a recently-developed Lagrangian stochastic model for deposition and resuspension of small particles from turbulent flows and rough surfaces will be outlined. The purpose of this presentation is to bring out the physics at play in particle deposition and resuspension studies as well as the remaining open questions that need to be addressed.

CV Jean-Pierre Minier graduated from Ecole Centrale de Paris (French engineering school) in 1985. After a first experience as an engineer in an oil company, he has been involved with developing models and numerical tools for the simulation of two-phase flows. He has been working at the research division of EDF (Electricité de France), in a department dedicated to fluid dynamics, heat transfer, two-phase flows, and environmental concerns. He has been specifically involved in the development of Lagrangian stochastic methods for dispersed reactive two-phase flows. He is the author of a number of publications in leading scientific journals, including several general review papers in physics journals and was the co-editor of two published books following international courses given at the CISM in Udine. The first one was on Stochastic Methods for Fluid Dynamics while the second one was on Particle Deposition, Resuspension and Agglomeration from wall-bounded turbulent flows.

