

ESDU SPC-M9-1

Dynamics of fouling deposition and removal in the presence of aging effects – Sept. 08 update

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**Imperial College
London**

Dynamics of fouling deposition and removal in the presence of aging effects

Sub-Project C: Fundamental Transfer Processes

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Introduction

Progress up to the April meeting:

- Simulations of fouling including deposition and removal in laminar flow.

Developments since then:

- Newtonian rheology → Aging (talk by Kirti)
- Rectangular geometry → Cylindrical geometry (talk by Daniele)
- Laminar flow → Turbulent flow (talk by Daniele)

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CROF Target

Ultimate aim: Simulations accounting for:

- Turbulence
- Cylindrical geometry
- Aging effects
- Thermodynamics and thermophysical properties

Target → April meeting

Introduction

Yield stress material: industrial material

Flow: stress is greater than yield stress

$$\sigma = \sigma_y + f(\dot{\gamma})$$

Applied stress

Yield stress

Shear rate

Flow if: $\sigma > \sigma_y$

Aging

Low flow rate
condition



Building up
of microstructure



Increase of
viscosity

Aging: time dependent viscosity

Thixotropic material

$$\mu = \mu_0 (1 + \lambda^n)$$

λ : is the degree of “jamming”

$$\frac{d\lambda}{dt} = \frac{1}{\tau} - \alpha \lambda \dot{\gamma}$$

Building-up Destruction
of microstructure

n, α, τ : system dependent
• constants

$\dot{\gamma}$: shear rate

t : time

μ_0 : characteristics viscosity

References:

- Huynh et al. Phys Fluids. 17, 033101, 2005
- Moller et al. Soft matter, 2, 274-283, 2006