

Deposition behaviour of very dense particles in high-concentration slurry flows

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Nuclear industry legacy waste

- Radioactive sludges/slurries exist on nuclear sites
- Waste, residues present in tanks, ponds, drains and other storage and transport vessels
- Sludges difficult to characterise: limited accessibility, radioactivity

“Hot particles”

- Radioactive particles found near nuclear sites in Scotland and Cumbria
- Sources unknown; could be fuel, casing, coolant, or other activated material
- Transport and deposition mechanisms not understood

Problems to be addressed

1. Nuclear legacy waste difficult to characterise, rheologically complex
2. Transport and deposition behaviour of very dense particles in slurry flows are not well understood

Objectives

To investigate dense, bimodal slurry flow in circular pipes, in terms of:

1. **Basic slurry flow data:** settling velocity, differential deposition
2. **Fundamental fluid-dynamical processes:** fluid-particle and particle-particle interactions

Experiments

Flow and deposition behaviour with two complementary sets of experiments:

1. Water + **glycerol**
2. Water + **low-density particles**

In each case, effective viscosity and concentration of high-density particles will be varied

Rationale

- Experiments to cover **large range of concentrations** to simulate dense slurries
- **Particle-particle interactions:** to be quantified by comparison of the two datasets
- Bimodal slurry: **simple analogue** for more complex, polydisperse slurries

Existing flow loop

1. 25mm gauge
2. Low particle concentration, low viscosity
3. Velocity data (UDVP and PIV)
4. Straight H section

New flow loop (under construction)

1. 40mm gauge
2. High particle concentration, high viscosity
3. Velocity data (UDVP) and physical sampling
4. Straight H section, V-H bend if time permits

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