Polymeric additives for reduction of erosion wear in particle-laden two-phase flows

R. Sean Sanders
NSERC Industrial Research Chair in Pipeline Transport Processes
Dept of Chemical & Materials Engineering, University of Alberta
Edmonton CANADA

Pipelines are essential components of any mining, mineral processing and oil production facility. Diverse examples include the subsea transfer and production lines in the North Sea and the long-distance pipelines in South America that carry mineral concentrates from high-altitude mines to coastal processing and shipping facilities. A critical issue of slurry pipelines (i.e. those transporting solids suspended in a liquid phase) is the potential for pipe failure due to surface wear caused by the progressive removal of pipe material by the solid particles. For many years this problem has been addressed primarily through the design and development of advanced materials. In many cases, though, there are significant economic barriers and technical risks in adapting new materials.

Rather than focusing on the material of pipe construction, we focus on the particle-wall processes that are the source of the erosion. In this particular project, the possibility of reducing erosion through the addition of low concentrations of high-molecular weight polymers is explored. In addition, the wear reduction mechanism that is associated with the effect of polymers on the turbulent motion of slurry particles is studied.

In this presentation, experimental studies conducted to systematically quantify pipe erosion rates during the transport of particle-laden flows as a function of polymer type and concentration, particle size and particle concentration will be discussed. As well, improved fundamental understanding of the underlying wear mechanisms is developed through detailed investigation of (i) the effect of the polymer on the liquid phase turbulent flow structures and (ii) the impact dynamics of particles using state-of-the-art particle image – particle tracking velocimetry.