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ABSTRACT

THE USE OF BOUNDARY LUBRICANTS FOR THE REDUCTION OF PARTICLE JAMMING IN ABRASIVE PARTICLE SLURRIES FOR JET CUTTING

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The development of an abrasive slurry jet (ASJ) is an important area of research in the abrasive water jet cutting industry. Direct pumping of abrasive slurries allows for more efficient use of the available energy of the high-pressure water, leading to faster cutting speeds, reduced cut kerf, and the potential to cut thicker materials. The development of ASJ technology requires the use of additives to create stable suspensions (against sedimentation) that are easily mixed, transported, stored, and pumped, and in particular that alleviate the problem of particle jamming in flow constrictions. This work investigates the effectiveness of surfactant boundary lubricants to increase lubricity and relieve jamming in model aqueous slurries of 50- μm diameter garnet abrasive particles. Lateral force microscopy (LFM) is used to characterize the lubricity of garnet surfaces pre-treated with cationic or neutral surfactants or functionalized with an octadecylsilane. All three treatments are found to produce significant increases in lubricity. The increases in particle surface lubricity are found to correlate with the results of macroscopic jamming tests in which garnet particle slurries are made to flow through the constriction provided by a syringe. Reductions of approximately 50% in jamming were achieved even under high particle loading conditions using the silane surface functionalization.