Nanoparticle Particle Flotation Collectors from High-Throughput Polymer Colloid Screening

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In mineral processing, flotation is a critical separation process for the isolation of valuable mineral particles from large volumes of unwanted gangue materials. For nearly a decade we have been exploring the use of polymer colloids to replace traditional low molecular weight collector molecules for the selective hydrophobization of mineral-rich particles. Flotation experiments with model glass bead suspensions have shown that nanoparticle flotation collectors are effective. However, in commercial flotation applications there are three conflicting requirements: 1) the polymer colloids must be as hydrophobic as nearly pristine polystyrene; 2) the polymer colloids must be colloidally stable in the high ionic strength environment in most flotation cells; and, 3) the polymer colloids must selectively deposit onto mineral-rich particles. For nickel ores, chelating amine or imidazole surface groups promote selective deposition and contribute to electrostatic stabilization, while lowering nanoparticle hydrophobicity. In an effort to optimize the surface composition we have used click chemistry to develop a library of candidate nanoparticles, and have developed high throughput colloidal stability assays and medium throughput hydrophobicity measurements to screen for effective nanoparticles. This presentation overviews the highlights of nine publications and illustrates both the advantages and pitfalls of high-throughput methodologies for colloidal applications.