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Thermal-reversible, size-selective desorption of nanoparticles from polymer brushes RICHARD VAIA, STEVE DIAMANTI, Air Force Reseach Lab, WPAFB, SHAFI ARIFUZZAMAN, JAN GENZER, Dept. Chem. & Biomolec. Eng, NCSU — The ability to reversibly modulate surface energy and chemistry will provide new opportunities for future separation and sensing technologies. Post-polymerization functionalization of covalently-tethered polymer brushes affords a robust platform technology for these goals. Using standard succinimide-based coupling, hydroxyl pendants of poly(2-hydroxyethyl methacrylate) (PHEMA) brushes were conjugated to oligo-peptides, alkanes, fluoroalkanes, and oligo(ethylene glycol) (OEG) through an alpha-terminus primary amine. Coupling of these different chemical moieties allows tailoring of the surface energy (θ_{H2O} ~40–110^o), that combined with PHEMA grafting density and molecular weight (MW), leads to tunable adsorption of analytes. OEG-modified PHEMA brushes exhibit thermal-reversible desorption of analytes that is size-selective. For example, Au NPs of larger size are liberated from the brushes at shorter heating times; hence mixtures of Au NPs of different sizes can be sequentially released by controlling substrate heating. The impact of electrolyte content, Au NP surface chemistry, coupling efficiency and OEG MW is discussed to elucidate the detailed molecular mechanisms dominating the size and temperature-dependent OEG-Au NP binding efficiency.

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