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Underwater acrobatics of partially-coated spheres DAREN WATSON, JOSHUA BOM, CHRIS SOUCHIK, ANDREW DICKERSON, University of Central Florida — Water entry studies traditionally investigate splash physics with homogeneous projectiles by tuning impactor shape, entry speed and surface roughness. Surface heterogeneity is yet another means to tune splash dynamics. In this combined experimental and theoretical study, we systematically investigate splash and cavity dynamics arising from the water entry of smooth, free-falling, partially-coated spheres across various drop heights. Hydrophilic spheres are partially-coated hydrophobic, and splash features for different impact orientations compared with the water entry of homogeneous spheres. Generally, flow separation is tripped when hydrophobic surfaces make contact with the fluid, leading to air-entrainment across the range of entry speeds and impact orientations tested. Spheres having hydrophilic and hydrophobic surfaces entering the fluid simultaneously experience lift forces, resulting in the deviation of trajectories from the axes of water entry. Here, we rationalize the migration of the fluid-sphere contact line and subsequent half-cavity expansion at high impact velocities. Such observations augur well for water entry applications where propulsion and electronic control are not possible.

Andrew Dickerson
University of Central Florida

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