Multilayered synthetic feathers for enhanced underwater superhydrophobicity ZAARA DEAN, FARZAD AHMADI, VIVERJITA UMASHANKAR, Virginia Tech, BRIAN CHANG, Temple University, SUNGH-WAN JUNG, Cornell University, JONATHAN BOREYKO, Virginia Tech — Submerged superhydrophobic surfaces can dramatically reduce hydrodynamic drag and bio-fouling, but the enabling air pockets are prone to irreversible collapse. Inspired by ducks, we demonstrate that air pockets within stacked layers of porous superhydrophobic feathers can withstand up to five times more water pressure compared to a single feather. In addition to natural duck feathers, the multilayered effect was replicated with synthetic feathers created by laser cutting micrometric slots into aluminum foil and imparting a superhydrophobic nanostructure. The mechanism for the multilayered enhancement is the more tortuous pathway required for water impalement, which serves to pressurize the enclosed air pockets. This was validated by a probabilistic impalement model and also by filling the feathers with an incompressible oil, rather than air, to suppress the multilayered effect.

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