Nano-rod Piezoelectrics for Icephobic Surfaces

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Prevention of icing has been a technological challenge for decades to increase the safety level for aircraft exposed to atmospheric icing environments. Icing is known to be a root cause in non-fatal and fatal aircraft accidents. Most current de-icing systems include either physical or chemical removal of ice, both energy and resource-intensive. New approaches are sought for designing and fabrication of ice repellent surfaces. The proposed work is a novel approach in icing mitigation by developing a multi-functional coating by integrating super hydrophobic surface (SHS) technology with nano-piezoelectric fibers. The effort is to demonstrate the feasibility of electrolysis reaction driven by piezoelectric. Growth of piezoelectric films of ZnO was explored as super hydrophobic surface. ZnO can be grown via aqueous chemistry route near room temperature, offering process simplicity, scalability and low-cost. *C*-axis oriented ZnO nano-rods were synthesized utilizing the reaction system employing hexa-methylene-tetramine (HMTA) and soluble zinc salts. The static water contact angle (WCA) was measured to guide the process route to achieve hydrophobic surfaces. Seed layer, Zn salt, Zn salt concentration, HMTA/Zn ratio, pH and time were experimentally varied. Results show that WCA is process dependent, static WCA varied from 7^{o} to 130^{o}. Highest WCA, 147^{o}, has been achieved by post treatment using self-assembled monolayer of stearic acid.