Abstract Submitted
for the DFD14 Meeting of
The American Physical Society

Enhanced Monopropellant Fuel Decomposition by High Aspect Ratio, Catalytic CNT Structures for Propulsion of Small Scale Underwater Vehicles KEVIN MARR, Department of Mechanical Engineering, Brigham Young University, Provo, UT, JONATHAN CLAUSSEN, Department of Mechanical Engineering, Iowa State University, Ames, IA, BRIAN IVERSON, Department of Mechanical Engineering, Brigham Young University, Provo, UT — Both maneuverability and efficiency for reagent-based propulsion systems of small-scale exploratory devices, such as autonomous underwater vehicles (AUVs), is largely dependent on their maximum fuel decomposition rate. Reagent-based systems, however, require large catalyst surface area to fuel volume ratios in order to achieve the fuel decomposition rates necessary for locomotion. This work demonstrates the utility of platinum-coated, carbon nanotube (CNT) scaffolds as high surface area catalysts for decomposition of hydrogen peroxide (H_2O_2) in a flowing environment. Usage of these functionalized microchannels ensures that both the maximum distance between fuel and catalyst is only half the microchannel diameter, and that the fuel concentration gradient increases due to boundary-layer thinning. These conditions facilitate intimate contact between fuel and catalyst and, therefore, faster decomposition rates. Electrochemical testing revealed that electroactive surface area to volume ratios of approximately 61.4 cm^{-1} can be achieved for samples fabricated using a static Pt deposition scheme. Thrust measurements were taken using a small-scale submersible which indicated a maximum thrust of 0.114 N using 50 weight percent H_2O_2 exposed to eight inline 2.867 cm^2 Pt-CNT scaffolds.

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Date submitted: 01 Aug 2014 Electronic form version 1.4