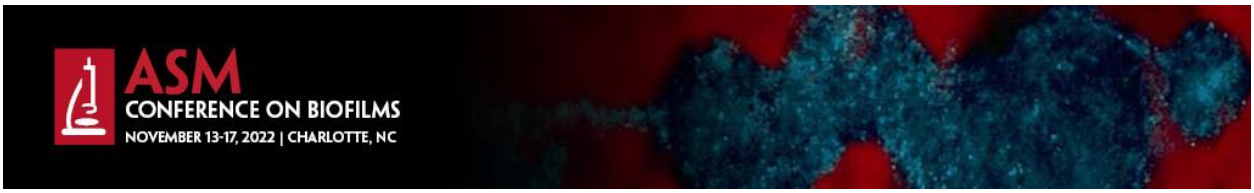

Biofilm Control by Engineering Antifouling Surface Topographies

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Microbial biofilms are a major cause of persistent infections associated with implanted medical devices and biomaterials. Despite decades of research, biofilm control remains challenging due to high-level tolerance of biofilm cells to antimicrobials and other disinfecting agents. Addressing this grand challenge requires in-depth understanding of microbe-biomaterial interactions and long-term biofilm control strategies. By investigating how bacteria interact with micron-scale topographies, we proposed a set of principles for rational design of antifouling topographies and validated the design using protruding topographic patterns. These findings inspired us to further develop new strategies based on dynamic topography and active topography for more effective biofilm control. Specifically, active topography with magnetically driven micron-sized pillars exhibited strong activities in both biofilm prevention and removal of mature biofilms of multiple microbial species. Such biofilm removal also sensitized the detached cells to conventional antibiotics, demonstrating a synergistic effect. A prototype catheter based on this design remained clean for more than 30 days under constant challenge of artificial urine with inoculated urophathogenic *Escherichia coli* (UPEC), while the control catheters were completely blocked within 5 days. The mechanisms and possible applications of these control strategies will be discussed.