Abstract Submitted
for the MAR09 Meeting of
The American Physical Society

Biomimetic and responsive artificial surfaces that quantitatively reproduce the water repellency of a Lotus leaf SPIROS H. ANASTASIADIS, VASSILIA ZORBA, EMMANUEL STRATAKIS, MARIOS BARBEROGLOU, EMMANUEL SPANAKIS, PANAGIOTIS TZANETAKIS, COSTAS FOTAKIS, ANCA MATEESCU, MARIA VAMVAKAKI, Foundation for Research and Technology-Hellas and Univ. of Crete, Heraklion Crete, Greece — We report an efficient method for preparing superhydrophobic and highly water repellent surfaces by irradiating silicon wafers with femtosecond laser pulses and subsequently coating them with alkylsilanes or polymer brushes. Such surfaces exhibit controlled dual-scale roughness at the micro- and the nano-scale and water contact angle properties very similar to those of the Lotus leaf. The water repellency of the artificial surfaces is quantified by studying the restitution coefficient of water droplets bouncing off the surfaces as a function of the droplet impact velocity; this is the first time such a direct comparison of performance is made and it clearly demonstrates the possibility of designing highly efficient biomimetic water repellent surfaces. When a polymer brush is "grafted from" these surfaces based on a pH-sensitive polymer, these artificially structured surfaces can alter their behavior from super-hydrophilic (after immersion in a low pH buffer) to super-hydrophobic and water-repellent (following immersion to a high pH buffer). Sponsored by NATO's Scientific Affairs Division, by the Greek GSRT and by the EU.

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Date submitted: 18 Nov 2008 Electronic form version 1.4