

Developing a non-optical platform for impact dynamics analysis on nanostructured superhydrophobic surfaces using an acoustic wave sensor

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Quantitative analysis of water behavior under dynamic conditions is one of the critical challenges. Despite the convenience of observation of water droplets, most of these techniques have limited applicability to microscopic and quantitative investigations. To overcome these limitations, we suggest a complementary analysis platform using a QCM to study impact dynamics. A high-speed camera and QCM were applied together to study the behavior of water droplets that impact wettability-controlled surfaces with various We numbers. ZnO nanowire were prepared and chemically modified by alkyl-thiol molecules. For nanowire surfaces with high surface energies and for the lowest surface energy sample, both methods exhibited consistent impact dynamics. QCM was able to provide microscopic information regarding the penetration and deformation of water droplets in a quantitative way. QCM was able to determine the metastable water repellency with a high We number, which could not be detected by the high-speed camera. These results suggest the significant potential of QCM as a new platform.