



BAMI Seminar – May 2016

Xue Zhang, PhD Student, BioPRIA/Department of Chemical Engineering

Friday 20th May 2016, 12.30PM to 1.30PM

Room G03, BioPRIA, 15 Alliance Lane (Building 59), Clayton Campus

Moderator: Llyza Mendoza, PhD Student, BioPRIA/Department of Chemical Engineering Monash University

Investigation on the effect of inorganic pigments on fabrication of super-hydrophobic paper

Abstract:

This study reports the preparation of super-hydrophobic paper via a facile two step dip coating method and investigation the effect of three kinds of inorganic pigments on fabrication of super-hydrophobic paper. For the fabrication method, in the first step, filter paper samples were dip coated using an aqueous suspension containing inorganic pigments and cellulose nanofiber, to form a highly rough layer on the surface of the filter paper. Subsequently, the coated papers were treated with a solution of alkyl ketone dimer (AKD) in n-heptane, which led to the formation of low-surface-energy surface. Precipitate Calcium Carbonate (PCC), Ground Calcium Carbonate (GCC) and Montmorillonite (MTM) were used as inorganic pigments nanoparticles to study the effect of forming a rough layer on the surface of the filter paper, respectively. The so-treated papers were characterized by contact angle (CA) measurements for wettability and scanning electron microscopy (SEM) for microstructure of the modified surfaces. For GCC-treated papers, contact angle measurements confirmed the super-hydrophobic nature of the paper prepared, which showed a contact angle of $156.7 \pm 2.4^\circ$. SEM analysis was carried out to characterize the surface differences of the coated samples with and without the added cellulose nanofibers and to clarify the binding role of cellulose nanofibers. It was also observed that the rough GCC coating layer lack of enough fine (nano-scale) structure, and thus the prepared super-hydrophobic surface has a relatively higher tilt angle ($\sim 15^\circ$). For MTM-treated papers, SEM analysis showed that the “surface concentration” of MTM on the paper surface was increased with the increase of cellulose nanofibers dosage. Contact angle measurements displayed that the MTM-treated papers with single AKD sizing were hydrophilic, while the MTM-treated papers with AKD sizing for twice were only hydrophobic, not super-hydrophobic. SEM was used to analyse the reasons for failure of fabrication a super-hydrophobic surface. The results showed that the MTM coating layer lack of micro-scale structure since dual hierarchical micro- and nano- structure should be provided for a super-hydrophobic surface according to previous research. In order to overcome the weakness of the MTM coating layer, GCC was added to MTM coating suspension to investigate the complementary effect. The results showed that the MTM/GCC treated paper had a contact angle of $162.4 \pm 3.3^\circ$ and tilt angle less than 5° . For PCC-treated papers, contact angle measurements illustrated that the PCC modified paper surface had a contact angle of $167.2 \pm 3.3^\circ$ and tilt angle much less than 5° .

Presentation and Q&A session will be from 12.30PM – 1.00PM. Lunch will be served at 1.00PM.

Enquires: BAMI Student Chapter coordinators Lionel Longe or Uthpala Garusinghe.