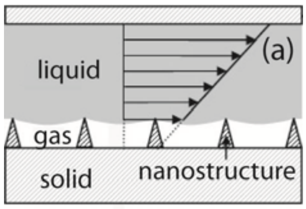
NANO - INTERFACES

Chiara Neto
Room 349, 9351 2752
chiara.neto@sydney.edu.au
http://www.chem.usyd.edu.au/research/neto.html

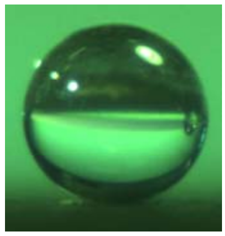
Research in my group focuses on phenomena that occur when liquids are confined on the nano- and micro- scales. We conduct experiments in a wide range of fields, including: ***functional surfaces, nano- and micro-patterned coatings, interfacial slip****. We are interested in understanding fundamental physico-chemical mechanisms, and also in their application in bio- and nano-technology. Most of our research is multi-disciplinary, spanning the traditional disciplines of chemistry, physics, materials science and engineering, biology and bio-engineering. A broad range of surface characterisation techniques is employed, including atomic force microscopy (AFM), optical microscopy, neutron and X-ray reflectometry, ellipsometry, X-ray photoelectron spectroscopy, and contact angle goniometry. Research projects are available in the following general areas.*

SLIP AT NANOPARTICLES



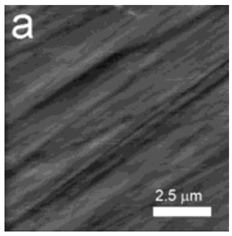
This project addresses the fundamental problem of interfacial slip and aims at identifying the nano-scale interfacial properties that make surfaces slippery. Problems of profound importance in pure and applied surface science will be addressed, and its results will dramatically affect many other research fields, such as microfluidics, confined biological systems, and colloidal stability.
This project consists primarily on measuring slip by measuring the diffusion of nanoparticles in a liquid by using high-resolution nanoparticle characterisation techniques, such as light scattering. This will be done in collaboration with the National Measurements Institute in Lindfield, where nanoparticles standards are defined in Australia. We will evaluate the ability of different surface treatments, such as self-assembled monolayer coatings, to enhance interfacial slip of liquids.

SUPERHYDROPHOBIC SURFACES



Water repellency is important in many technological applications, such as self-cleaning water-proof surfaces and microfluidic devices. The hydrophobicity of a surface can be enhanced by a chemical and topographical modification, which leads to an increase in the contact angle of a water drop, with values reaching the theoretical maximum of 180 degrees (Figure). We develop new approaches for the modification of surface properties and for the fabrication of superhydrophobic surfaces, and we investigate their potential applications. In this project we will collaborate with the surface coating industry to design novel superhydrophobic coatings and test their performance as self-cleaning coatings on the walls and roof of buildings.

MICROSCOPIC STUDIES OF PYRITE SURFACES



Explosive emulsions are widely used in the mining as cost-effective blasting systems with high efficiency and detonation velocity. Learning how to gain greater flexibility and efficiency in the use of these emulsions without compromising safety in hot and reactive ground has been a major issue for the mining industry. We will use modern methods of surface chemistry analysis to investigate the properties of pyrite that is highly reactive in contact with explosive emulsions. A detailed molecular description of the pyrite surface and its treatment with inhibitors should allow a more rational choice of materials and methods to effect a solution to reactive ground problems. Microscopic examinations of the interactions between pyrite and the emulsion will provide a physical model for the breakdown of the emulsion.

SELECTION OF RECENT PUBLICATIONS

[1] Zhu, L., P. Attard, and C. Neto, Reliable measurements of interfacial slip by colloid probe atomic force microscopy: II hydrodynamic force measurements. *Langmuir*, 2011. 27: p. 6712–6719.
[2] Zhu, L., P. Attard, and C. Neto, Reliable measurements of interfacial slip by colloid probe atomic force microscopy: I. Mathematical Modelling. *Langmuir*, 2011. 27: p. 6701–6711. [2]
[3] Neto C, Joseph KR, Brant WR. On the superhydrophobic properties of nickel nanocarpets. *Phys Chem Chem Phys*. 2009;11(41):9537 – 44.
[4] Willmott, G.R., C. Neto, and S.C. Hendy, Uptake of water droplets by non-wetting capillaries. *Soft Matter*, 2011. 7(6): p. 2357-2363.
[5] Thickett, S.C., C. Neto, and A.T. Harris, Biomimetic Surface Coatings for Atmospheric Water Capture Prepared by Dewetting of Polymer Films. *Advanced Materials*, 2011. 23(32): p. 3718-3722.

Please feel free to come and talk to me and members of my group for further information.