Wetting of rough particles @ flat liquid-liquid Interfaces

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Wetting of colloids is one of the most studied phenomena in surface science. It has fascinated researchers since the early decades of 20th century [1,2] and still nowadays presents great perspectives for further investigations. Particularly, wetting of rough colloids has recently gained increasing interest due to the potential of rough particles to stabilise more effectively emulsions and foams [3,4], as well as from a more fundamental point of view in relation to the generation of capillary forces [5,6,7]. Moreover, even if standard colloids are considered to be perfect spheres, they are not necessarily smooth and homogeneous at the nanoscale and those heterogeneities may have a strong impact on the particles' behaviour at interfaces. To date, all investigations on the effects of particle surface roughness have been limited to indirect evidence, linking particle surface properties to macroscopic behavior at interfaces, e.g. aggregation [8], viscoelasticity [9] or motion [10], and systematic microscopic studies are missing. Here, we employ Freeze-fracture Shadow-Casting (FreSCa) combined with cryo-SEM imaging [11] to investigate for the first time the wetting of sub-micron colloids with tailored surface roughness. In this work, all-silica model rough particles with tuneable and controlled surface roughness were synthesised and imaged by FreSCa at flat liquid-liquid interfaces in order to shed light on the role of roughness for the wetting of individual particles in an exhaustive and systematic fashion. We observed that roughness strongly affects the wetting due to contact line pinning and that particles beyond a critical roughness do not even breach the interface.

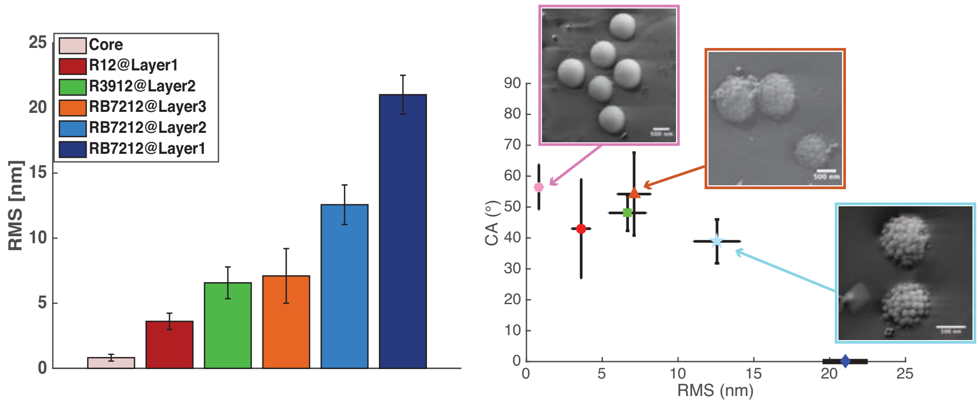

Figure 1 Surface roughness of the different synthesised colloids (left) and the impact it has on the wetting (right)

Acknowledgements The authors thank the Scientific Center for Optical and Electron Microscopy of ETH Zurich (SCOPEM) for support. The Swiss National Science Foundation is acknowledged for financial support through the grant PZ00P2 142532/1.

[1] W. Ramsden, Proceedings of the Royal Society of London, 1903, **72**, 156.
[2] S.U. Pickering, Journal of the Chemical Society, Transactions, 1907, **91**,2001.
[3] A. San-Miguel, S.H. Behrens, Langmuir, 2012, **28**, 12038.
[4] C.J. Mable, N.J. Warren, K.L. Thompson, O.O. Mykhaylyk, S.P. Armes, Chemical Science, 2015,**6**, 6179.
[5] D. Stamou, C. Duschl, D. Johannsmann, Physical Review E., 2000, **62**, 5263.
[6] J.B. Fournier, P. Galatola, Physical Review E., 2002, **65**, 031601.
[7] P.A. Kralchevsky, N.D. Denkov, K.D. Danov, Langmuir, 2001, **17**, 7694.
[8] W.Chen, S. Tan, Z. Huang, T-K. Ng, W.T. Ford, P. Tong, Physical Review E., 2006, **74**, 021406.
[9] R. Van Hooghten, L. Imperiali, V. Boeckx, R. Sharma, J. Vermant, Soft Matter, 2013, **9**,10791.
[10] N. Sharifi-Mood, I.B. Liu, K.J. Stebe, Soft Matter, 2015, **11**, 6768.
[11] L. Isa, F. Lucas, R. Wepf, E. Reimhult, Nat. Commun., 2011, **2**, 438.