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What information can frictional properties of polymer brushes tell us? ZHENYU ZHANG, Department of Physics and Astronomy, University of Sheffield, Sheffield, S3 7RH, UK, MARK MOXEY, ANDREW MORSE, STEVEN ARMES, Department of Chemistry, University of Sheffield, Sheffield, S3 7HF, UK, ANDREW LEWIS, Biocompatibles UK Ltd., Chapman House, Farnham Business Park, Weydon Lane, Farnham, Surrey, GU9 8QL, UK, MARK GEOGHEGAN, Department of Physics and Astronomy, University of Sheffield, Sheffield, S3 7RH, UK, GRAHAM LEGGETT, Department of Chemistry, University of Sheffield, Sheffield, S3 7HF, UK — We have used friction force microscopy (FFM) to quantitatively examine surface grown zwitterionic polymer brushes: poly(2-(methacryloyloxy)ethyl phosphorylcholine) (PMPC), and to establish the correlation between its frictional behaviour to other intrinsic properties. In a good solvent, it was found that the coefficient of friction (μ) decreased with increasing film thickness. We conclude that the amount of bound solvent increases as the brush length increases, causing the osmotic pressure to increase and yielding a reduced tendency for the brush layer to deform under applied load. When measured in a series of alcohol/water mixtures, a significant increase in μ was observed for ethanol/water mixtures at a volume fraction of 90%. This is attributed to brush collapse due to co-nonsolvency, leading to loss of hydration of the brush chains and hence substantially reduced lubrication. We show that single asperity contact mechanics is strongly dependent on solvent quality. Friction-load relationship was found linear in methanol (good solvent), but sub-linear in water and ethanol (moderate solvent).

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