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Colloidal Epitaxy

Epitaxial growth remains the technique of choice to grow functional surface nano and microstructures. Homoepitaxial growth laws have, in fact, been found to be applicable in colloidal systems as well and have helped realize the growth of uniform colloidal thin films [1]. For numerous technological applications, however, achieving spatial control over island nucleation, island shape and size, is necessary. In this talk, I will first describe a soft-lithography approach that allows us to control the location of colloidal island nucleation and island shape and size by a single lithographic parameter [2]. Interestingly, the nucleation kinetics followed during film growth is identical to atomic heteroepitaxy. We will show that graded surface potentials inherent to our approach help realize inter-island periodicities that are not achievable in conventional patterned epitaxy. I will finish my talk by discussing findings on the growth of colloidal thin films on uniformly strained templates [3,4,5].

[1] Direct Measurements of Island Growth and Step-edge Barriers in Colloidal Epitaxy, Rajesh Ganapathy, Mark R. Buckley, Sharon Gerbode and Itai Cohen, **Science** 327, 445 (2010)

[2] Site-specific Colloidal Crystal Nucleation by Template-enhanced Particle Transport, Chandan K Mishra, AK Sood and Rajesh Ganapathy, **Proceedings of National Academy of Sciences U.S.A.** 113, 12094 (2016)

[3] Entropy Driven Crystal Formation on Highly Strained Substrates, John R Savage, Stefan R Hopp, Rajesh Ganapathy, Sharon J Gerbode, Andreas Heuer and Itai Cohen, **Proceedings of National Academy of Sciences U.S.A.** 110, 9301 (2013)

[4] Cooperative Particle Rearrangements Facilitate the Self-organised Growth of Colloidal Crystal Arrays on Strain-relief Patterns, Manodeep Mondal, Chandan K Mishra, Rajdeep Banerjee, Shobhana Narasimhan, A K Sood and Rajesh Ganapathy, **Science Advances** **6**, Issue 10, eaay 8418 (2020)

[5] Non-monotonic Layer-dependent Diffusivity in Colloidal Heteroepitaxy, Manodeep Mondal and Rajesh Ganapathy (in preparation 2021)

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