Colloidal lithography approaches to study plasmon coupling and plasmonic devices

Duncan S. Sutherland[1], Hans Dyrnesli[1], Gunnar Klös[1], Maria G.D.R.H. Salazar[1], Kasper R. Okholm[1] and Vladimir E. Bochenkov[2]*

[1)]Aarhus University, Aarhus, Denmark
[2)]Lomonosov Moscow State University, Moscow, Russia
[*)] E-mail duncan@inano.au.dk

In the last two decades a wide range of nanofabrication approaches have been developed based on top down lithography or bottom up self assembly. Here approaches based on colloidal monolayer masks combined with cleanroom processing such as Sparse Colloidal Lithography (SCL) [1] and Hole Mask Colloidal Lithography (HMCL) [2] will be presented. Traditionally these approaches have given arrays of circularly symmetric structures such as disks [3], holes [4], rings [5] and cones [2]. More recent approaches have allowed post-modification of the masks to change their size [6] or their shape. Colloidal lithography approaches have proven appropriate to allow arrays of novel plasmonic structures to be fabricated to study plasmon coupling [7], refractive index sensitivity [8] and chiral properties of arrays [9]. In this paper we report on a number of new fabrication approaches based on programmable angled evaporation, or post or pre-modification of colloidal masks. Figure 1 shows a range of post-modifications that can be made to the masks materials in HMCL and SCL to generate new structures. Specific examples of sensational biosensing [10] chiroptical materials and novel structures will be made. In situ deposition of sacrificial material of dielectric (e.g. Silicon oxide or Aluminium oxide) or metal (e.g. Silver or Aluminium) can be used to prepare mask materials that can be modified within the process and generate a systematically varied set of samples. Examples will be given of subtractive processes to generate 2D and 3D structures by first depositing silicon oxide or aluminium which is later removed by etching to generate asymmetric plasmonic structures. Other examples will be given of processes depositing silicon oxide mask materials registered to the colloidal nanoparticle defined patterns to allow fabrication of rings, crescents and asymmetric rings. Examples of final structures will be given.

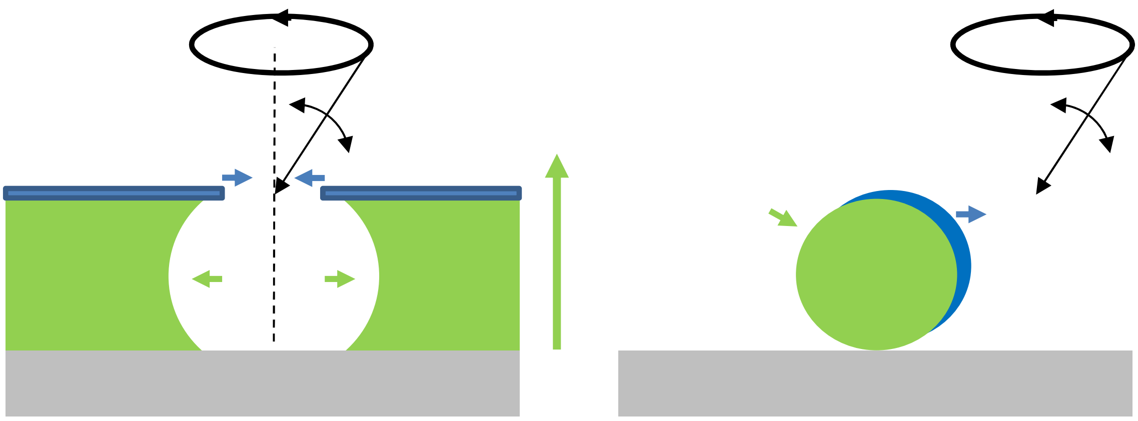

Figure 1.Schematic representation of mask modifications in Hole Mask Colloidal Lithography (HMCL) and Sparse Colloidal Lithography (SCL)

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