Supporting Information:
Growth of thiol-coated Au-nanoparticles Langmuir monolayers through 2D-network of disk-like islands

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Size of DT-AuNPs from UV-vis and TEM

The optical absorption spectra of the thiol-coated Au-nanoparticles (DT-AuNPs) in toluene solution were collected with a UV-vis spectrophotometer (Lambda 750, Perkin Elmer), while the transmission electron micrographs of the DT-AuNPs, deposited on a carbon-coated copper grid, were observed using transmission electron microscope (JEM 2100, JEOL). Typical UV-vis spectrum and TEM image for the DT-AuNPs are shown in Fig. S1. A broad hump near 520 nm is observed in the optical absorption spectrum (Fig. S1a), which is a characteristic surface plasmon resonance (SPR) band of the AuNPs. The peak becomes quite prominent, after subtraction of exponentially decaying background. The size of the core AuNPs ($2R$) is estimated from the full width at half maximum (FWHM) of this peak, which is about 2.5 nm. Formation of AuNPs is also evident from TEM image (Fig. S1b) and corresponding particle size histogram is shown in the inset. The value of $2R$, as estimated from the particle size distribution curve, is 2.5±0.6 nm, which is consistent with the size estimated from optical absorption measurement. The average size of the DT-AuNPs is then about 4.5 nm, as the dodecanethiol capping thickness is nominally assumed to be 1 nm.

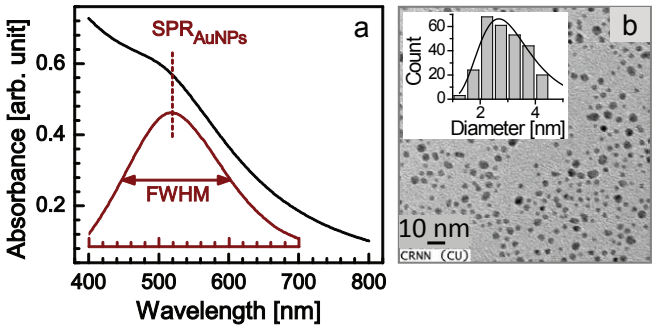

Fig. S1 (a) UV-vis spectrum of AuNPs in solution and corresponding background subtracted spectrum to emphasize the SPR peak and its FWHM and (b) typical TEM image of AuNPs in grid and corresponding size histogram in the inset.

Resolution limit along q_y-direction in GISAXS

The resolution limit along q_y-direction is a very important parameter in understanding the long-range in-plane correlations in a system, such as the domains, if any. Such resolution limit depends upon the detector-to-sample distance, beam-size and most importantly on the beam divergence. Increase in the value of first one and decrease in the values of latter two decreases the value of the resolution limit, which in turn increases the measurement length scale. However, the scattering intensity decreases for the increase in the detector-to-sample distance and for the decrease in the beam size. Thus high intensity, low divergence micro-focused beam is essential which is available at MiNaXS beamline of PETRA-III.[1] The detector-to-sample distance and beam divergence imposed resolution limit along q_y-direction (about 0.002 Å^{-1}), as observed from the GISAXS line profiles, is marked by the vertical line in Fig. S2. Such resolution limit can very well determine any long-range in-plane correlations within 300 mn length scale.

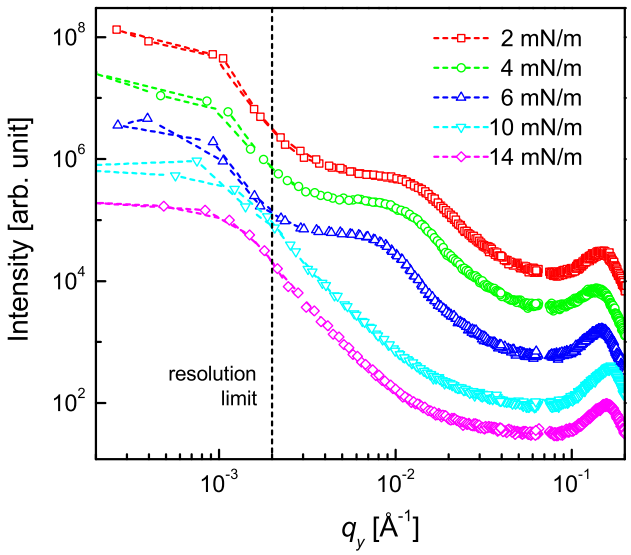

Fig. S2 GISAXS line profiles along q_y direction for the DT-AuNPs/H-Si LS films deposited at different surface pressure. Curves are shifted vertically for clarity. The straight dashed line marked the resolution limit along q_y direction.

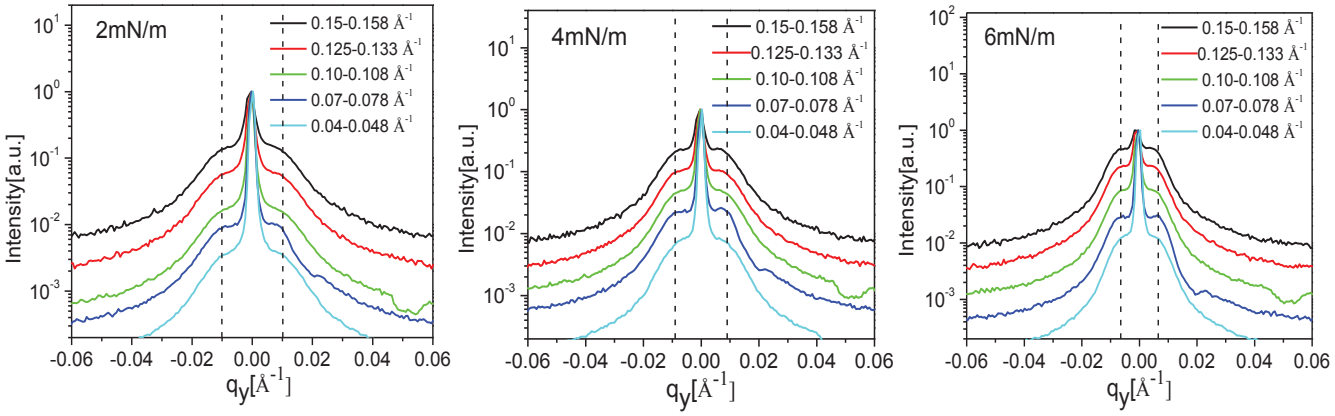

Fig. S3 GISAXS line profiles along q_y direction, extracted from different ranges of q_z values, for the DT-AuNPs/H-Si LS films deposited at three different surface pressure. The positions of the correlation peaks are indicated by the dashed lines.

GISAXS line profiles

The GISAXS line profiles along q_y direction are extracted by integrating different portion of q_z values for the DT-AuNPs/H-Si LS films deposited at three different surface pressure and are shown in Fig. S3. It is clear from the figure that the positions of the shoulders (indicated by dashed lines in Fig. S3) around the central peak, which move toward the center with increasing Π value, remain changed with the q_z value. This indicates that the position of q_z value is not very important for the extraction of horizontal line profile from the GISAXS image.

Topography of DT-AuNPs/H-Si LS films from SEM

The topography of the DT-AuNPs/H-Si LS films, at large scale, were imaged by scanning electron microscope (Quanta 200 FEG). Such SEM images for the DT-AuNPs/H-Si LS films, deposited at four different surface pressure, are shown in Fig. S4. It is clear from the figure that there is no increase in the coverage of the film with surface pressure, at least, in large scale. However, the contrast of the image increases with surface pressure, which is probably associated with the increase in the thickness and/or coverage, in small scale.

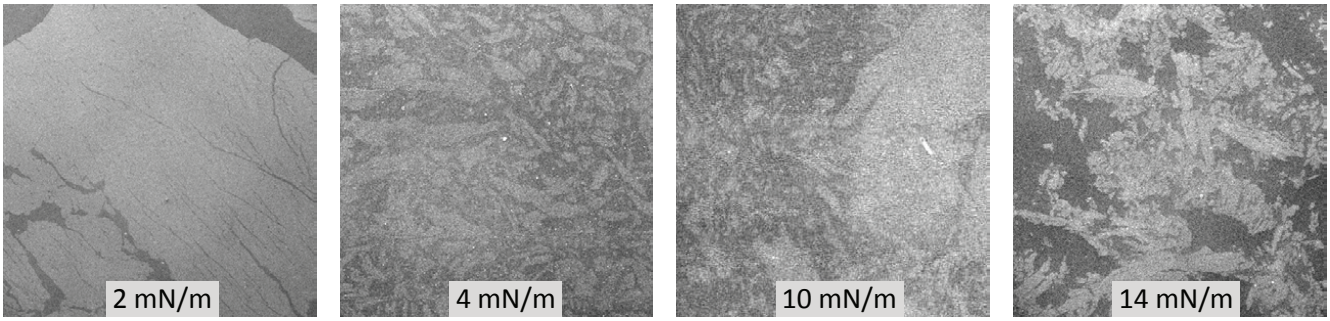

Fig. S4 SEM images of the DT-AuNPs/H-Si LS films deposited at different surface pressure, showing topography in large (2.5×2.5 mm^2) scan size.

Acknowledgements

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References

[1]A. Buffet, A. Rothkirch, R. Döhrmann, V. Körstgens, M. M. Abul Kashem, J. Perlich, G. Herzog, M. Schwartzkopf, R. Gehrke, P. Müller-Buschbaum and S. V. Roth, *J. Synchrotron Rad.* 2012, **19**, 647.