Visualization of Lamellar Structure of $C_{36}H_{74}$ on HOPG

Normal alkane $C_{36}H_{74}$ is one of the chain molecules that adopts the extended all-*trans* (zig-zag) conformation in bulk crystals. The estimated molecular length of $C_{36}H_{74}$ is 4.7 nm. A specific feature of normal alkanes is their epitaxial order on atomically flat surfaces of highly oriented pyrolitic graphite (HOPG) and dichalcogenides of transition metals. The lamellar structures with flat-lying chains are formed by normal alkanes, and lamellar width equals to the extended molecular length. Tri-fold symmetry is common for such lamellar order.

Two sets of AFM images, which were recorded on spin-cast $C_{36}H_{74}$ layers on HOPG with Si probe (k = 1.9 N/m), are presented below to illustrate visualization of lamellar structures. In one sample the large-scale height images show multiple domains of alkanes attached to the edges of crystalline planes, **Figure 1a**. On terraces one can see spherical particles, which are scattered on flat areas and assembled at the edges, **Figure 1b**. One of the locations with several particles was imaged first at low force, **Figure 1c-d**. A faint stripped pattern can be noticed on flat areas between the particles. The situation has changed as the tip-force was raised by lowering the set-point amplitude from 12 nm to 8 nm, **Figure 2a-d**.

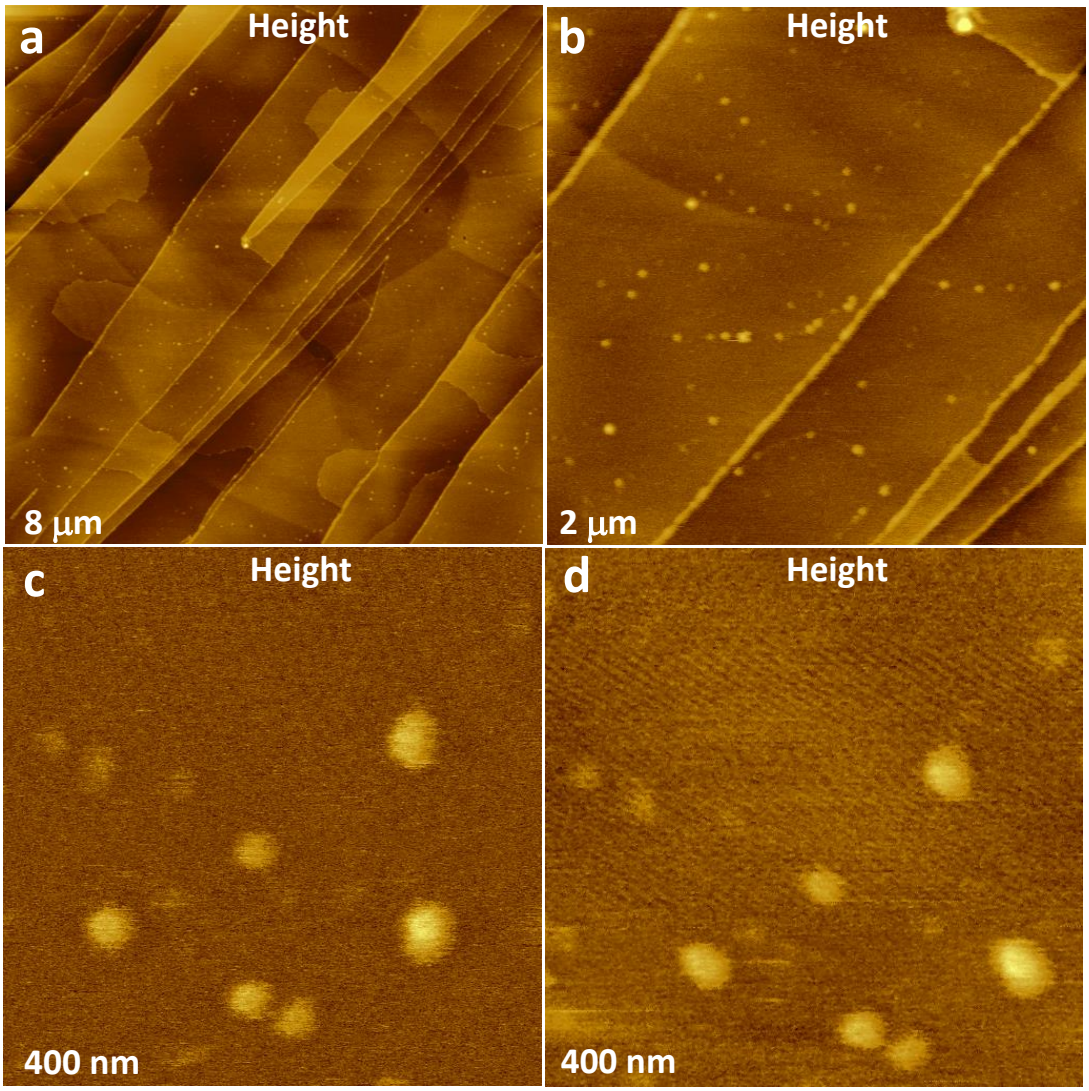

Figure 1a-d. Height and phase images of $C_{36}H_{74}$ adsorbate on HOPG substrate.

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As the tip-force increases, a stripped pattern has emerged in the height and phase images. Both images exhibit a well-ordered pattern and only traces of spherical particles are seen. The image changes are caused by the probe penetration through a top surface layer. The probe smears the particles and reveals the lamellar order by depressing the lamellar edges. The averaged lamellar spacing in the images (4.9 nm) is close to the length of $C_{36}H_{74}$ molecule.

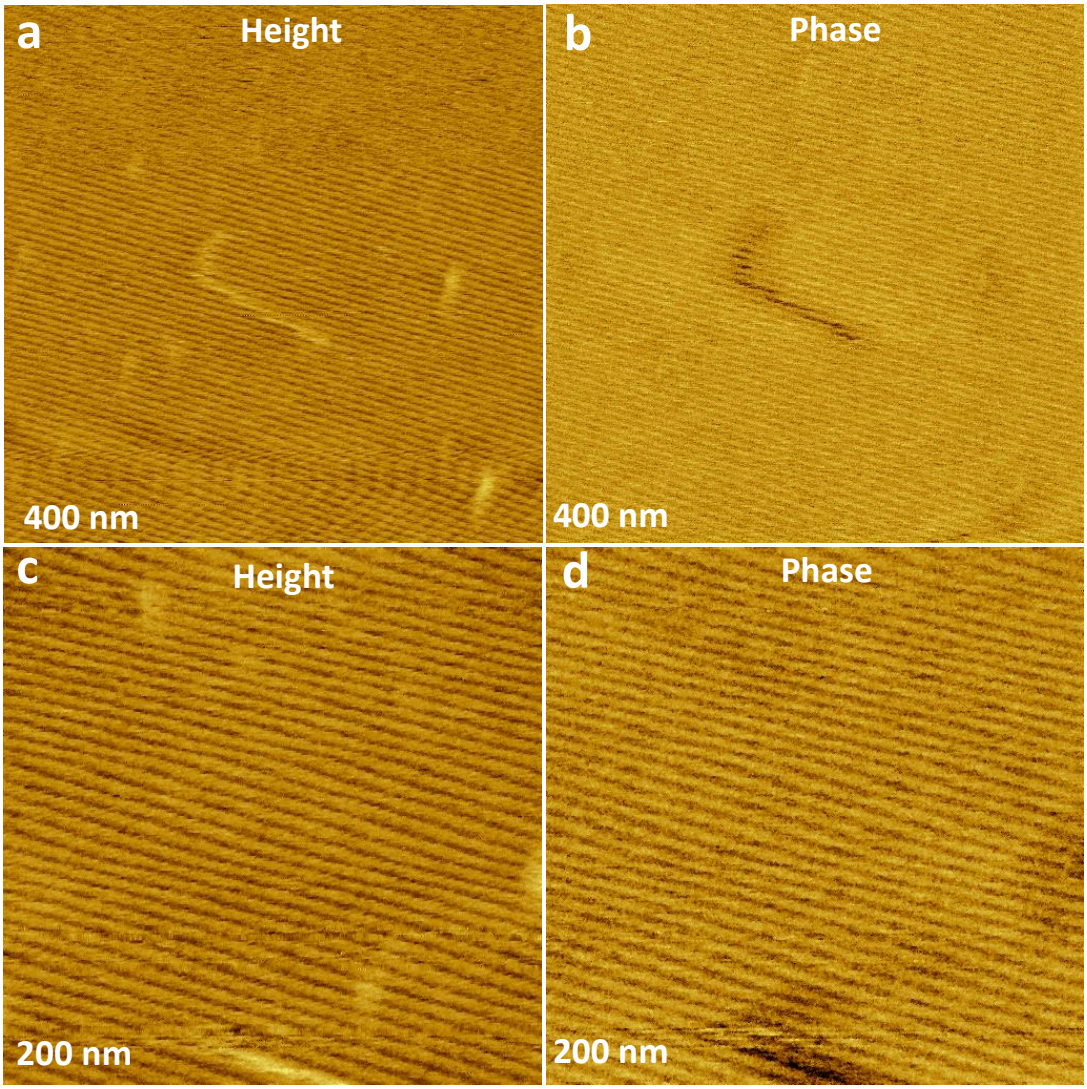

Figure 2a-d. Height and phase images of $C_{36}H_{74}$ adsorbate on HOPG substrate.

Height and phase images of another sample with $C_{36}H_{74}$ layer on HOPG are presented in **Figure 3a-f**. The large-scale height images (**Figure 3a-b**) show features that are similar to those observed on the surface of the previous sample. There are multiple top surface domains, which represent the weakly-bonded adsorbate species. They are disturbed and smashed away by a scanning probe, particularly, as the imaging area is reduced, **Figure 3b**. At smaller scale the height and phase images (**Figure 3c-f**) reveal a lamellar order in this surface complete layer. The observed striped pattern exhibit three-fold symmetry of the alkane epitaxy of HOPG.

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More about AFM of lamellar structures is in Applications/Paper 2 on our Website.

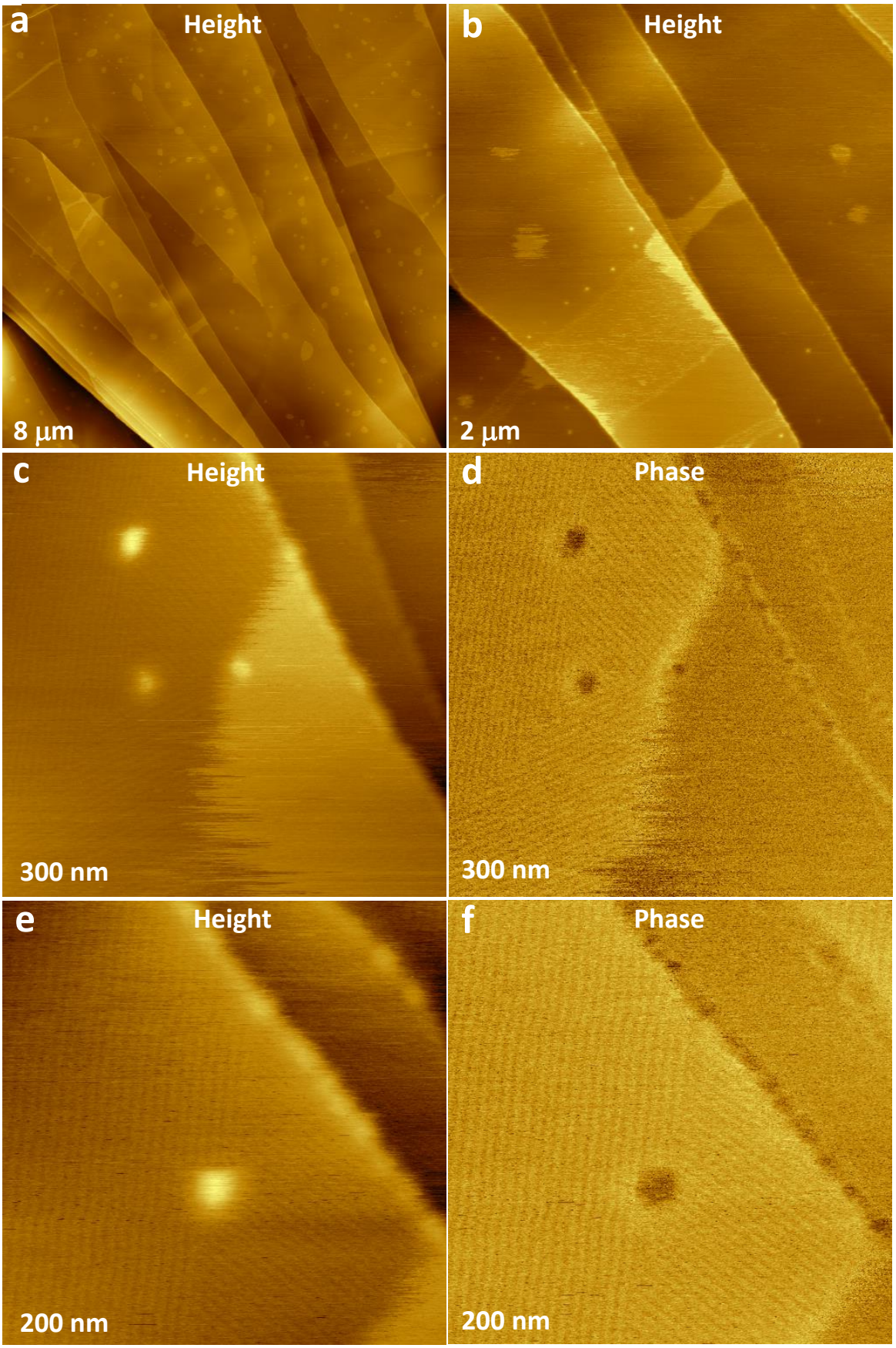

Figure 3a-f. Height and phase images of $C_{36}H_{74}$ adsorbate on HOPG.