250 DVDs ON A QUARTER: NEW METHOD OF SELF-ASSEMBLING NANOSCALE ELEMENTS COULD TRANSFORM DATA STORAGE INDUSTRY

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The sawtooth ridges formed by cutting and heating a sapphire crystal serves to guide the self-assembly of nanoscale elements into an ordered pattern over arbitrarily large surfaces. An innovative and easily implemented technique in which nanoscale elements precisely assemble themselves over large surfaces could soon open doors to dramatic improvements in the data storage capacity of electronic media.

The density achievable with the technology we've developed could potentially enable the contents of 250 DVDs to fit onto a surface the size of a quarter.

Shown is an atomic force microscope image of ultra-dense, highly ordered nanoscale elements, looking down from the top. The dots, only 3 nanometers in size and each equidistant from the other, are spaced at a density of 10 terabits per square inch.

Scientist explained that the molecules in the thin film of block copolymers - two or more chemically dissimilar polymer chains linked together - will self-assemble into an extremely precise, equidistant pattern when spread out on a surface, much like a regiment of disciplined soldiers lining up in formation but the order starts to break down as the size of area increase.

To overcome this size constraint, scientists conceived of the elegantly simple solution of layering the film of block copolymers onto the surface of a commercially available sapphire crystal. When the crystal is cut at an angle - a common procedure known as a miscut - and heated to 1,300 to 1,500 degrees Centigrade for 24 hours, its surface reorganizes into a highly ordered pattern of sawtooth ridges that can then be used to guide the self-assembly of the block polymers.

The beauty of the this method is that it takes from processes already in use in industry, so it will be very easy to incorporate into the production line with little cost.