Notes

Supplementary Information:

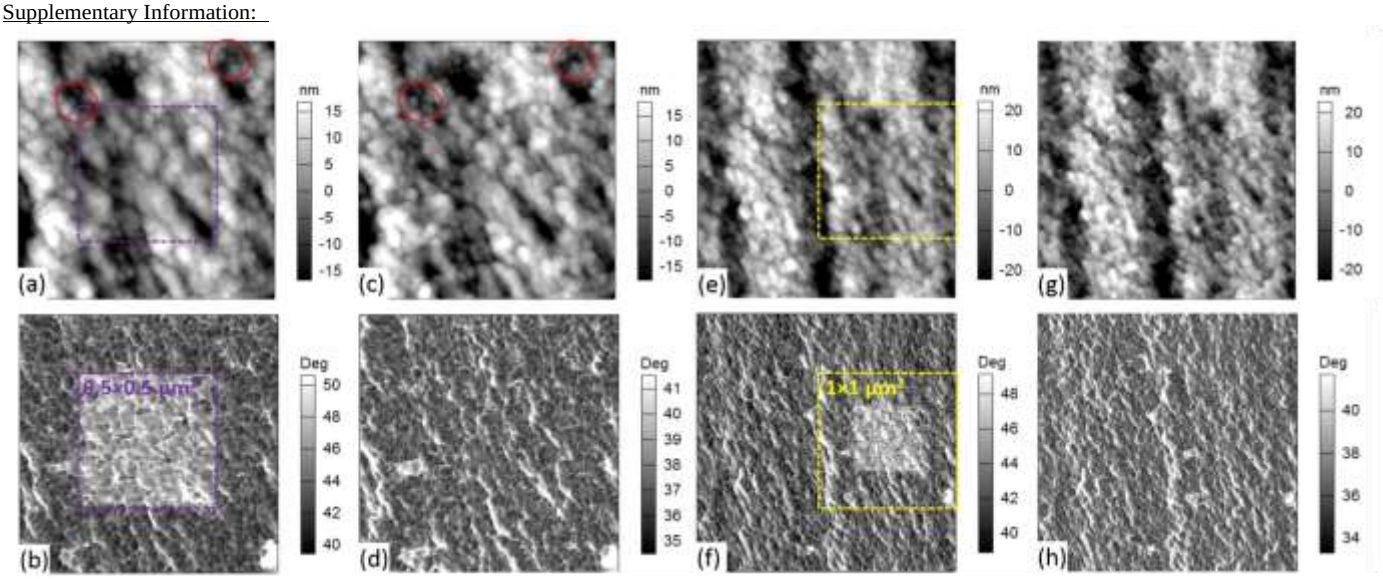

Fig. S1 AFM (tapping mode) topography (1st row) and phase (2nd row) images obtained at the same location before (c, d, g and h) and after (a, b, e, and f) the BE-CR-FM measurements. BE-CR-FM measurement was performed in the area of 0.5×0.5 μm^2 [marked by purple square in (a) and (b)]. The scan size for (a)-(d) is 1×1 μm^2, while for (e)-(h) is 2×2 μm^2. All of the images are composed by 512×512 pixels. The area (1×1 μm^2) scanned in (a) to (d) is maked by the yellow square in (e) and (f).

Fig. S1 shows the AFM images for the area scanned by BE-CR-FM technique (0.5×0.5 μm^2) as well as the surrounding area [Figs. S1(a) - (d): 1×1 μm^2 and Figs. S1(e) - (h): 2×2 μm^2]. Comparing the images in the first two columns of Fig. S1, the BE-CR-FM scanned area has clear topography and property changes indicated by the larger nanograins and increased phase values respectively. In addition, some of the nanograins outside this BE-CR-FM scanned area are also changed, such as those highlighted in the red circles [Figs. S1(a) and (c)]. Those particles appear either enlarged, rotated or displaced. These changes are primarily due to the rearrangement of the microconstituents due to the loading force during the BE-CR-FM measurement. Tip blunting may also play a role, but it does not have significant effects on the rearrangement of the nanograins. This can be approved by the AFM images shown in Figs. S1(e) to (h). In these 2×2 μm^2 size of images, the nanograins farther away from the BE-CR-FM scanned area do not show any significant difference before and after the BE-CR-FM scan, except the slightly reduced resolution which may be due to the tip blunting. Moreover, although the changes of the size or orientation of the nanograins can be found at the regions near the BE-CR-FM scanned area, there are also some nanograins still remain at their initial state, with the same shape, size, and orientation. Therefore, it can be concluded that the BE-CR-FM technique induced the topographic changes in the large area (extended beyond the scanned region) are mainly due to the interconnectivity and strong bonding among the microconstituents in nacre, but not the tip-blunting induced artifact.