

Electronic supplementary information

Experimental details of SEM observation

Nacreous samples for SEM observation were mechanically cut from the shells of Red Abalone and the cross section was successively ground down to 800[#] grit wet abrasive paper. Then, they were polished with 50nm aluminum oxide suspension in the same condition, keeping the polishing direction being perpendicular to the habit plane of the nacre tablets. To eliminate the intra-crystalline organic matrix as much as possible, some selected samples were annealed at 250 °C for 60h. Considering that the annealed samples were too brittle to prepare for SEM observation, the cyanoacrylate adhesive was used to strengthen their mechanical properties. After the cyanoacrylate adhesive drying, an annealed sample was embedded into epoxy with an unheated sample, keeping the habit planes of two samples being parallel to each other. Then, all embedded samples were successively ground down to 800[#] grit wet abrasive paper and polished with 50nm aluminum oxide suspension, keeping the polishing direction being perpendicular to the habit plane of the nacre tablets. All polished samples got dry in air at room temperature after rinsed thoroughly with distilled water for 2min. Finally, they were observed with FESEM (HITACHI S-4800) after gold sputter-coating for 60s.

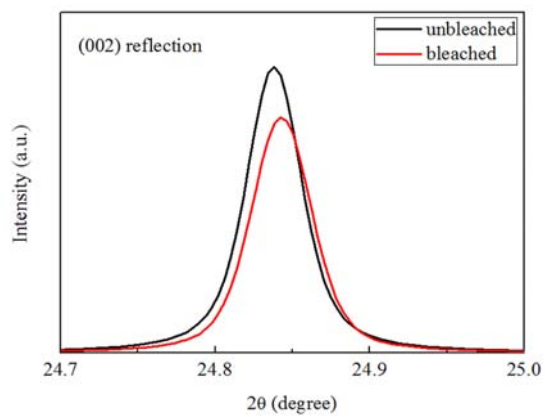


Figure S1. Comparison in angular positions of the synchrotron (002) diffraction profile between unbleached sample (black line) and sample bleached for two weeks (red line).

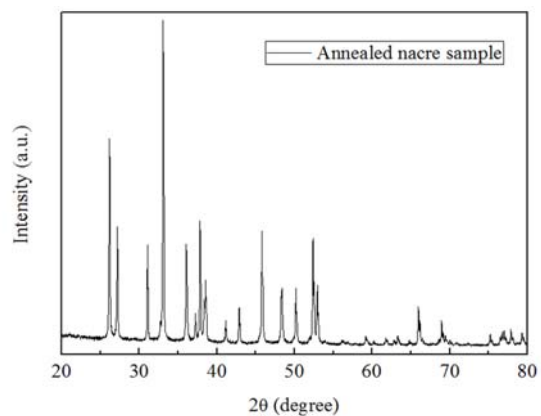


Figure S2. The X-ray powder diffraction pattern of annealed sample, showing clear diffraction peaks of aragonite crystal.

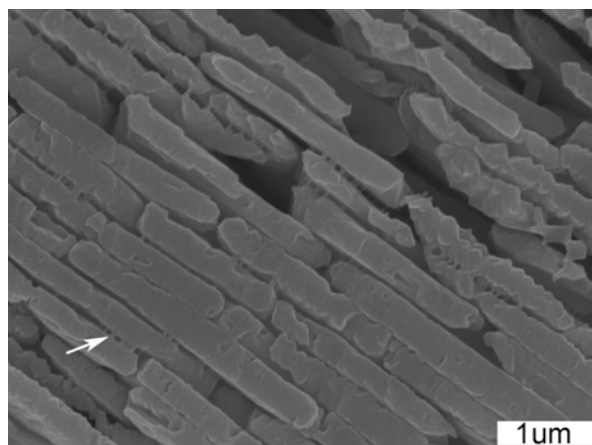


Figure S3. SEM image shows an almost smooth morphology on the polished surface, which has been bleached for 2h in 5% sodium hypochlorite. The white arrow indicates the inter-crystalline organic matrix is removed and the tablets are connected by mineral bridges.