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Vertically oriented structure and its fracture behavior of the Indonesia white-pearl oyster

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Abstract

Structural calcites, aragonites, and the bonding organic network decide the growth, structure and mechanical properties of the mollusk bivalvia shell. Here, it was found out that the calcite prisms together with the coated organics construct another kind of 'brick and mortar' structure similar to the aragonite tablets. The calcite layer can be divided into three sublayers and direct evidences show that the calcite prisms are produced by two methods: nucleation and growing in the first sublayer; or fusing from the aragonites, which is quite different from some previous reports. The crystallographic orientation, micro hardness and crack propagations were tested and observed by XRD, micro hardness tester, SEM and TEM. Submicron twin crystals were observed in the immature aragonite tablets. The fracture processes and the micro deformation of the aragonite tablets are detected by acoustic emission (AE) in the tensile tests, which gave the interpretation of the dynamical fracture processes: plastic deformation and fracture of the organics, and friction of the minerals at the first two stages; wear and fracture of the minerals at the third stage. Calcites and aragonites are

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