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3-D structure and dynamics of microtubule self-organization[1]
JING WANG, H. DANIEL OU-YANG, Lehigh University — Laser scanning confocal microscopy was used to study the dynamics of 3D assemblies spontaneously formed in microtubule (MT) solutions. Microtubule solutions prepared by mixing and incubating tubulin in the presence of GTP and Oregon Green conjugated taxol in PM buffer were placed in long, sub-millimeter thin glass cells by the capillary action. Within 24 hours, starting with a uniform distribution, microtubules were found to be gradually separated into a few large "buckled" bundles along the long direction, and in the middle plane, of the sample cell. A well-defined wavelength of the buckling sinusoids was around 510 μm. The cross section of these round bundles was approximately 40 μm in diameter and the lengths were several centimeters. Detailed analysis of the 3-D image within the bundles revealed that each bundle seemed to consist of loosely packed MTs. It appeared that MTs were phase separated resulting from attractive interactions between charged MT fibers. The "buckling" behavior could be the result of geometrical constraints of the repulsive cell walls and the repulsive interaction between bundles. Detailed 3-D observations of the dynamic evolution of MT assembly could provide insight to the mechanisms of cellular MT organization and phase separation of charged colloidal rods.

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