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标题: Concentration Methods for High-Resolution THz Spectroscopy of Nucleic-Acid Biomolecules and Crystals
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摘要: Biomolecules can exhibit low-lying vibrational modes in the THz region which are detectable in transmission given a strong molecular dipole moment and optical depth, and a spectrometer of adequate sensitivity. The nucleic acids are particularly interesting because of applications such as label-free gene assay, bio-agent detection, etc. However for nucleic acids, sample preparation and THz coupling are of paramount importance because of the strong absorption by liquid water and the small concentration of molecules present in physiological solutions. Concentration methods become necessary to make the THz vibrational modes detectable, either by concentrating the nucleic-acid sample itself in a small volume but large area, or by concentrating the THz radiation down to the volume of the sample. This paper summarizes one type of the first method: nanofluidic channel arrays for biological nucleic acids; and two types of the second method: (1) a circular-waveguide pinhole, and (2) a circular-waveguide, conical-horn coupling structure, both for DNA crystals. The first method has been demonstrated on a very short artificial nucleic acid [small-interfering (si) RNA (17-to-25 bp)] and a much longer, biological molecule [Lambda-phage DNA (48.5 kbp)]. The second method has been demonstrated on small (similar to 100 micron) single crystals of DNA grown by the sitting-drop method.
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