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Miniature IR Waveguides for Evanescent-Wave Spectroscopy of Individual Intact Cell Membranes

M. Braiman, S. Shilov (Syracuse U.)

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We have developed methods for embedding miniature planar IR sensor elements flush at the surface of rigid substrates. The planar Ge waveguides have thickness down to ~10 micron, and widths of 0.5-1 mm. These waveguides are tapered in thickness along their 50-mm lengths to permit efficient coupling of light into the ~10 micron sensing region without requiring an IR microscope. The waveguides can therefore be positioned with their sensor surface horizontal. Such waveguides can be used as mid-IR evanescent-wave sensor elements for small biological samples. They display exquisite sensitivity to small numbers of analyte molecules at their surface. It is possible to collect high-throughput broadband spectra, e.g. of tiny liquid droplets or membranes of individual cells, in a matter of seconds. Use of synchrotron light with the waveguides permits investigation of the dependence of sensitivity on input light angle. Preliminary results indicated a significant improvement in sensitivity with synchrotron IR light.