**Section:**
Terahertz Optics and Biophotonics V

**Title:**
THz solid immersion microscopy: Recent achievements and challenges

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**Abstract:**
Unique effects of terahertz (THz)–wave–matter interaction push rapid progress in THz optoelectronics aimed at bridging the problematic THz gap [1]. However, majority of modern methods of THz spectroscopy and imaging are still hampered by low spatial resolution. Common lens/mirror-based THz optics fails to overcome the Abbe barrier and usually provides resolution larger than a free-space wavelength λ (i.e., hundreds of micrometers or even few millimeters) [2,3]. To mitigate this difficulty, supperresolution THz imaging modalities were introduced recently, among which we particularly underline different methods of THz scanning-probe near-field microscopy. They not only rely on strong light confinement on sub-wavelength probes and provide resolution down to $10^{-1}$–$10^{-3}$λ but also suffer from small energy efficiency or presume an interplay among imaging resolution, signal-to-noise ratio, and performance [4]. In our work, we consider reflection-mode THz solid immersion (SI) microscopy that offers some compromise between the high imaging resolution of 0,15λ and high energy efficiency, which is due to the absence of any subwavelength probe in an optical scheme [2,3]. Recent achievements, challenging problems, and prospects of SI microscopy are overviewed [5–8] with an emphasis on resolving the inverse problem and applications in THz biophotonics [9,10].

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