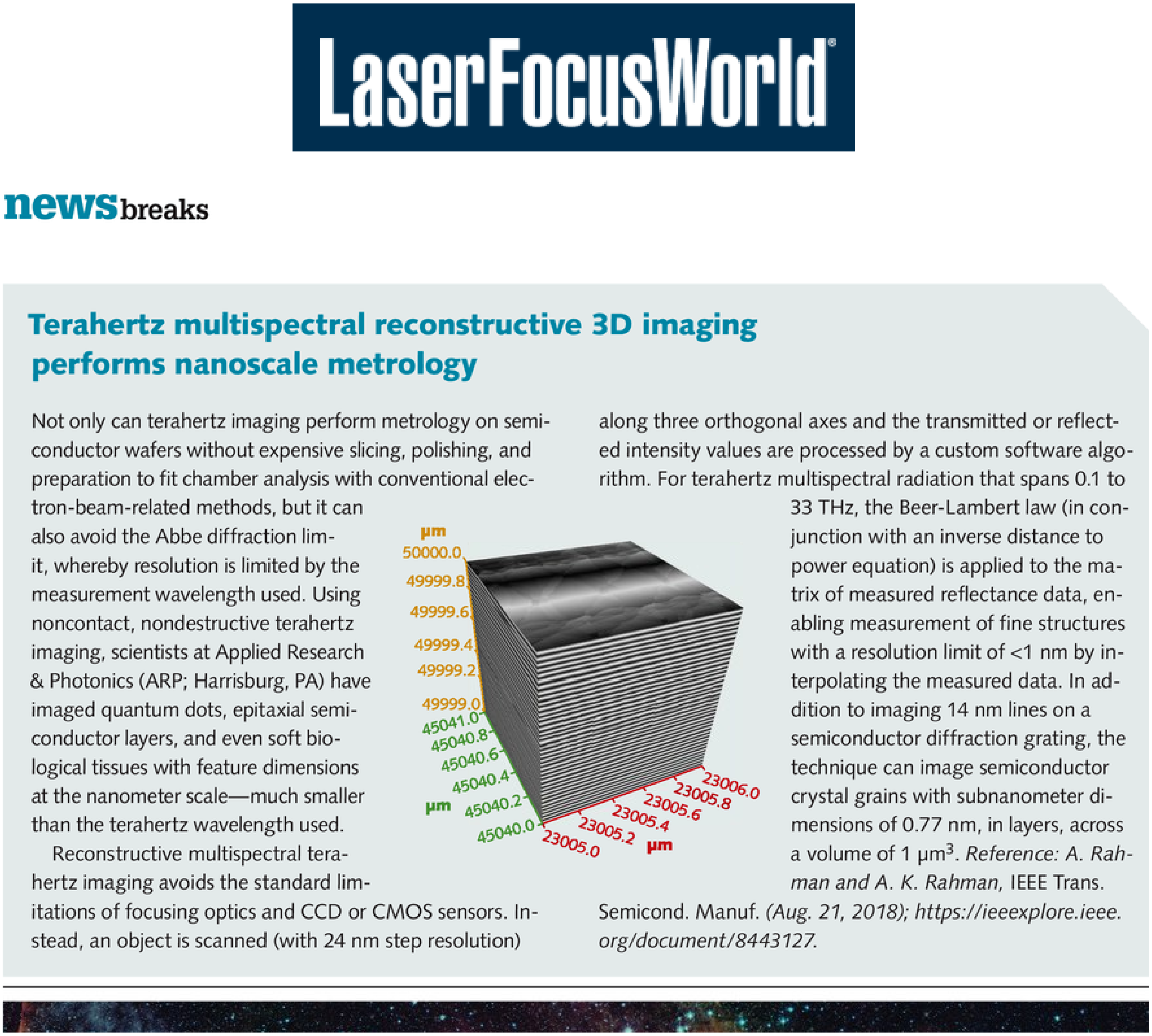

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newsbreaks

Terahertz multispectral reconstructive 3D imaging performs nanoscale metrology

Not only can terahertz imaging perform metrology on semiconductor wafers without expensive slicing, polishing, and preparation to fit chamber analysis with conventional electron-beam-related methods, but it can also avoid the Abbe diffraction limit, whereby resolution is limited by the measurement wavelength used. Using noncontact, nondestructive terahertz imaging, scientists at Applied Research & Photonics (ARP; Harrisburg, PA) have imaged quantum dots, epitaxial semiconductor layers, and even soft biological tissues with feature dimensions at the nanometer scale—much smaller than the terahertz wavelength used.

Reconstructive multispectral terahertz imaging avoids the standard limitations of focusing optics and CCD or CMOS sensors. Instead, an object is scanned (with 24 nm step resolution) along three orthogonal axes and the transmitted or reflected intensity values are processed by a custom software algorithm. For terahertz multispectral radiation that spans 0.1 to 33 THz, the Beer-Lambert law (in conjunction with an inverse distance to power equation) is applied to the matrix of measured reflectance data, enabling measurement of fine structures with a resolution limit of <1 nm by interpolating the measured data. In addition to imaging 14 nm lines on a semiconductor diffraction grating, the technique can image semiconductor crystal grains with subnanometer dimensions of 0.77 nm, in layers, across a volume of 1 µm^3. *Reference: A. Rahman and A. K. Rahman,* IEEE Trans. Semicond. Manuf. *(Aug. 21, 2018); https://ieeexplore.ieee.org/document/8443127.*

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