NEWSBREAKS

Ceramic Nd:YAG microchip provides high-efficiency laser output

Working with the Japanese Technical Research Center (Kitakyushu, Japan) and Osaka Institute of Technology, researchers at the Japanese Institute for Molecular Science (Okazaki) recently demonstrated high-efficiency lasing from a diode-pumped ceramic chip of Nd:YAG. The polycrystalline YAG ceramic allows high neodymium doping levels that overcome the low absorption cross section; the absorption coefficient of a conventional Nd:YAG crystal is 3.45 cm^{-1} at 808 nm for a neodymium concentration of 0.9 at.%—at the 4.8 at.% used in their experiment, the researchers report absorption of the Nd:YAG ceramic as about 10 cm^{-1}. The result is a device that produces an output power four times that of a conventional Nd:YAG crystal. According to researcher Takunori Taira, scattering losses for the ceramic microchip are much lower than for conventional ceramics. The test results, which were presented at February's OSA Advanced Solid State Laser conference (Boston, MA), indicate that the Nd:YAG ceramic has potential as a microchip laser. *Contact Takunori Taira at* taira@ims.ac.jp.

Reflection confocal microscope reads out three-dimensional optical data

Reading out data stored in a three-dimensional photochromic medium has always proved harder than writing them into the medium. Researchers at Osaka University (Osaka, Japan) and Victoria University of Technology (Victoria, Australia) have applied a reflection confocal microscope (RCM) to the task with promising results. An RCM eliminates the problem encountered by a transmission confocal microscope, in which the focus deviates from the pinhole because of refractive index inhomogeneity in the memory medium and substrate. With the detector and pinhole located in the reflected path between the laser source and the memory medium and with proper optical parameters, the researchers found that an RCM is able to accurately read out data in the same spatial band in which they were written. Poly(methylmethacrylate) films doped with a photochromic molecule provided the optical memory medium. The three-dimensional data were written with a Ti:sapphire laser at 760 nm, which induced photoconversion of the chromophores at the focus position via two-photon absorption. Readout was performed by a helium-neon laser emitting at 633 nm. *Contact S. Kawata at* kawata@ap.eng.osaka-u.ac.jp.

Nanoporous polymer films demonstrate high optical transmission

A low refractive index is essential if antireflection coatings are to limit light reflection off glass surfaces and increase the quality of optical lens systems. Obtaining this low refractive index has usually required a sequence of coating layers creating destructive interference, which maximizes light transmission. Recently, researchers at the Universität Konstanz (Konstanz, Germany) developed a single homogeneous layer comprising a nanoporous polymer film that achieves this same goal. The research team led by Jürgen Mlynek demonstrated the concept by spin-casting a binary polymer mix of polystyrene and polymethylmethacrylate (PPMA) onto glass, then exposing the mix to the solvent cyclohexane, which selectively dissolved polystyrene and left a porous film of PMMA behind. Atomic force microscopy verified the absence of lateral structures larger than 100 nm and revealed an irregular surface rather than individual pores.

An index of refraction of 1.255 [PC1]was obtained, along with optical transmission through the glass as high as 99.3%, which is comparable to or better than the industrial standard—magnesium fluoride. The researchers say the major advantages of their approach are the ability to fine-tune the refractive index of the film and, with multiple layers, further reduce

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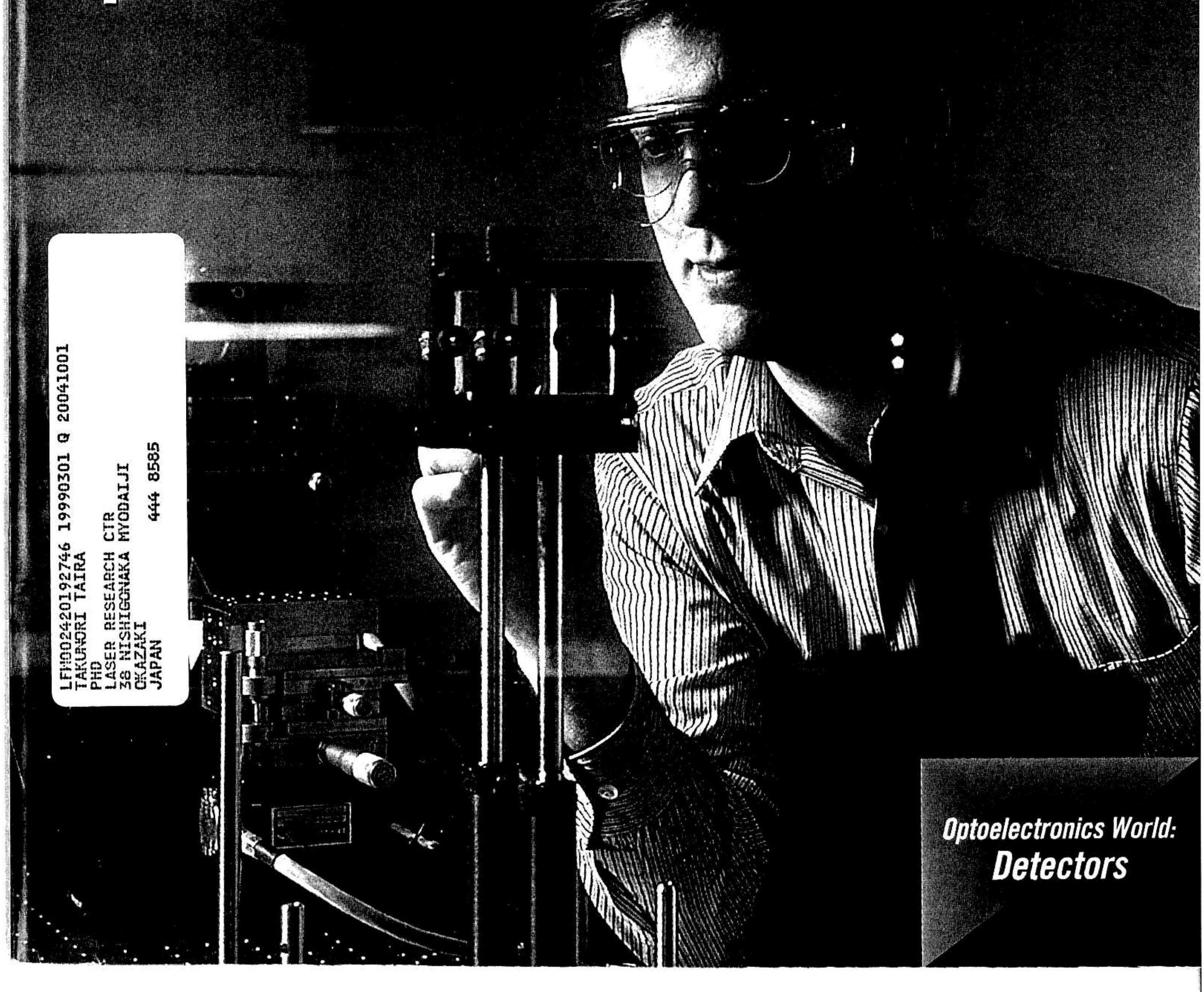

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