

is also a fourth fiber, which is used for monitoring power.)

- Two of the fiber optical paths include delay lines containing electro-optical modulators.
- In operation, the modulators are used to create phase shifts that alter the interference fringes in ways that aid the extraction of the desired information.
- Images of the phase-shifted interference fringes are captured, digitized, and then analyzed by use of a very robust fringe-tracking and phase-unwrapping algorithm developed specifically for this gauge.
- The final product of the analysis is a map, accurate to 1 nm or less, of the deviation from flatness of the component under test.

The third gauge is denoted the split-fiber-beam, single-fiber interferometer. This gauge utilizes a reference optical flat that has been calibrated by use of the three-fiber gauge for measuring the optical-corner/siderostat-mirror-surface distance. A single laser beam is delivered by an optical fiber, and is split in half and collimated by two off-axis paraboloidal reflectors. The collimated first half beam is aimed at the siderostat/retroreflector assembly. The light reflected from the assembly is sent back toward the fiber by the same paraboloid that collimated it. This light is then reflected from the tip of the optical fiber and interferes with the second half beam coming out of the fiber. The resulting two divergent beams are inter-

cepted and collimated by the second paraboloidal reflector, then focused by a third paraboloidal reflector onto an image detector for analysis of interference fringes. For the purpose of shifting phases in order to shift interference fringes to aid the extraction of the required information, the siderostat/retroreflector assembly is mounted on a closed-loop, three-axis piezoelectric transducer that moves the assembly in controlled steps that can be resolved to 1 nm.

This work was done by Yekta Gursel of Caltech for NASA's Jet Propulsion Laboratory. Further information is contained in a TSP (see page 1). NPO-30804

Improved Electrolytic Hydrogen Peroxide Generator

Energy efficiency exceeds that of a prior electrolytic H₂O₂ generator.

Lyndon B. Johnson Space Center, Houston, Texas

An improved apparatus for the electrolytic generation of hydrogen peroxide dissolved in water has been developed. The apparatus is a prototype of H₂O₂ generators for the safe and effective sterilization of water, sterilization of equipment in contact with water, and other applications in which there is need for hydrogen peroxide at low concentration as an oxidant. Potential applications for electrolytic H₂O₂ generators include purification of water for drinking and for use in industrial processes, sanitation for hospitals and biotechnological industries, inhibition and removal of biofouling in heat exchangers, cooling towers, filtration units, and the treatment of wastewater by use of advanced oxidation processes that are promoted by H₂O₂.

The apparatus is an electrochemical cell in which the electrodes are located on opposite sides of a commercially available polymeric membrane, which separates the electrolytes of the two electrolytic half-reactions. One of the half-cells produces the biocidal aqueous H₂O₂ product; the product of the other half-cell restores the biocidal solution to potability. The apparatus is designed to process water that is neutral (in the sense of neither acidic nor alkaline) or nearly neutral, to consume minimal energy, and to operate without need to supply nonregenerable material(s) other than the small proportion of water that is electrolyzed.

The energy efficiency of the cell is increased through improved microscopic mixing of the electrolytes near

the electrodes without need for large bulk electrolyte flow rates: this is accomplished by rotating the electrodes relative to the rest of the cell (in contradistinction to forcing electrolyte flow over stationary electrodes). Even though the design of this prototype cell is unoptimized, the total energy consumption per unit of product was found to be 60 percent less than that of a common planar H₂O₂-generating cell in operation at similar Faradaic and production rates.

This work was done by Patrick I. James of Eltron Research, Inc., for Johnson Space Center. For further information, contact the Johnson Innovative Partnerships Office at (281) 483-3809. MSC-23093

High-Power Fiber Lasers Using Photonic Band Gap Materials

PBG materials would be exploited to increase power levels and efficiencies.

NASA's Jet Propulsion Laboratory, Pasadena, California

High-power fiber lasers (HPFLs) would be made from photonic band gap (PBG) materials, according to the proposal. Such lasers would be scalable in the sense that a large number of fiber lasers could be arranged in an array or bundle and then operated in phase-locked condition

to generate a superposition and highly directed high-power laser beam. It has been estimated that an average power level as high as 1,000 W per fiber could be achieved in such an array.

Examples of potential applications for the proposed single-fiber lasers include

welding and laser surgery. Additionally, the bundled fibers have applications in beaming power through free space for autonomous vehicles, laser weapons, free-space communications, and inducing photochemical reactions in large-scale industrial processes.