

Jones Group News Updates

Topic: Luminescence Detection of a Spore Coat Marker

In the Photochemical Laboratory of the Photonics Center, research and development activities are focused on the detection of pathogens using light as a probe of biological markers. A significant study has been recently completed that results in the highest sensitivity reported to date for the detection of a chemical, dipicolinic acid (DPA), that is an important component of the coatings of bacterial spores, including those associated with anthrax. According to this method, spores are broken down using straightforward chemical techniques and trace levels of DPA are quantitated. The recent study has focused on improvement by at least two orders of magnitude the effectiveness of a test that is based on complexation of DPA with the metal, terbium. The work is carried out in collaboration with a research group located at the Army Research Laboratory (Adelphi MD) which provides funds for the project.

G. Jones, II and V. I. Vullev, Medium Effects on the Photophysical Properties of Terbium (III) Complexes with Pyridine-2,6-dicarboxylate, *Photochemical and Photobiological Sciences*, 2002, 1, 925. This paper was selected as the lead article and cover feature for the 12th issue of the PPS journal for 2002.

Topic: The Solid State Dye Laser

Dye lasers have been used for years for a variety of tasks that span ranging, weaponry, and photomedicine. They provide exceptional wavelength selectivity combined with high output power. Heretofore, this class of laser had the disadvantage of requiring circulating liquids/solvents (the lasing medium) and large cumbersome apparatus. At the forefront of work on dye lasers currently is research on solid state devices that are miniaturized, compact, and less expensive. Work carried out in our Photochemistry Laboratory, in partnership with a private company (Physical Sciences, Inc. of Andover MA), and sponsored by the Department of Defense, has resulted in a breakthrough first demonstration of pumping of a dye-doped plastic with a semiconductor diode laser. This prototype device has significant output power that is delivered in the near infrared (NIR) spectral region, a spectral domain that is attractive for military applications because it is readily transmitted in ambient atmospheres and is undetected by eye. For medical applications, these new systems (now, all solid state) show promise as well because of the penetration of NIR light through tissue. The diode-pumped dye laser was reported for the first time at Photonics West, 2003 and is cited in the meeting paper noted below:

G. Jones, II, Z. Huang, and D. Pacheco, "Fluorescence and Lasing Properties of Meso-substituted Benzo-fused Pyrromethene Dyes in Solid Host Media, *SPIE-Int. Soc. Opt. Eng.* (Solid State Lasers XII), (2003), in press.

Topic: Artificial Photosynthesis – Solar Energy Conversion

The photochemistry laboratory has also been engaged in research sponsored by the Office of Basic Energy Sciences of the Department of Energy that is devoted to photochemical storage of solar energy (work spanning more than ten years). The objective of this project is to mimic the mechanisms that are activated by light in the green leaf (i.e., natural photosynthesis). The strategy is to build in the laboratory synthetic proteins that have some of the same features found in natural proteins that harvest light in plant membranes. This effort also relates to the congressional Nanoscience Initiative in terms of the dimensions of the synthetic ‘molecular wires’ generated in this research. Success of this work depends heavily on the use of pulsed laser devices that allow live ‘snapshots’ to be taken of electron transport reactions that occur in billionths of a second. Laser and spectrometer equipment used in this work were provided through grants from the DOD.

A review submitted from our laboratory of progress in the field has been published recently:

V. I. Vullev and G. Jones, II, “Photoinduced Charge Transfer in Helical Poly-peptides,”
Res. Chem. Intermed., **28**, 795 (2002).

See also:

G. Jones, II and V. I. Vullev, “Photoinduced Electron Transfer between Non-Native Donor-Acceptor Moieties Incorporated in Synthetic Polypeptide Aggregates,” *Organic Lett.*, **4**, 4001 (2002)

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