Mid-infrared emission spectroscopy of laser generated carbon plasmas

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Mid infrared time-resolved emission (IrLIBS) spectra were recorded from laser-induced carbon plasma at Hampton University, Virginia, USA. These spectra constitute the first report of carbon materials LIB spectroscopy in the mid infrared range. The plasma was induced using a Q-switched Nd: YAG laser. The laser beam was focused to high purity graphite pellets mounted on a translation stage. Mid infrared emission from the plasma in atmospheric pressure background gases was detected by a cooled MCT detector in the range 4.5-11.6 micrometer, using long-pass filters. The spectra were taken in argon, helium and also in nitrogen and were background corrected and noise filtered. A 0.15 m spectrometer with gratings blazed at 8 micrometer was used. Spectral resolution was around 80 nm. Several spectral runs were averaged using a boxcar averager. Even though a gate delay of 10 to 20 microseconds was used there were strong backgrounds in the spectra. Superimposed on this background broad and noisy emission bands were observed, the form and position of which depended somewhat on the ambient gas. In argon, for instance strong bands were observed around 4.8, 6.0 and 7.5 micrometer. Using atomic spectral data by NIST it could be concluded that carbon and argon lines from neutral and ionized atoms are very weak in this spectral region. The width of the infrared bands also supports molecular origin. The infrared emission bands were thus compared to vibrational features of carbon molecules (excluding C_2) and clusters of various sizes on the basis of previous carbon cluster infrared absorption and emission spectroscopic analyses in the literature and quantum chemical calculations. Applications of these results are expected in materials science, environmental chemistry and also in astrophysics.

Biography

Laszlo Nemes is graduated and certified chemical engineer in 1959 from the Technical University of Budapest. He joined at the research network of the Hungarian Academy of Sciences and he have been associated ever since with that organization. His main fields are molecular spectroscopy, laser and plasma spectroscopy. He got his Ph D degree from the Technical University of Budapest (1965), a DSc.degree from the Hungarian Academy of Sciences (1982), and posses "venia legendi" as a habilitated, titular professor in physical chemistry at the Technical University of Budapest (1995). He held several grants and stipends to do research and teaching abroad. He also visited Great Britain in the years 1964-65. In 1972-73 he had a Dozentenstipendium from the German Alexander von Humboldt-Stiftung for work at the University of Kiel , later he was reactivated in 1982 as humboldt-fellow at the Justus-Liebig-University, Giessen. In 1985 he was visiting scientist at the Herzberg institute of astrophysics, National Research Council of Canada, Ottawa and in 1986 a state professorship in France at Villeneuve d'Ascq (Universite de Lille). In 1990 he spent time at the Catholic University of Nijmegen, Laboratory of Molecular and Laser Physics (The Netherlands). In 1991 he was visiting research scientist at the chemistry department, University of Michigan, Ann Arbor, USA. He worked at the University of Waterloo, Canada in the Center for Molecular Beams and Laser Chemistry in 1992 and 1993 and he have spent a year as guest research professor of the Academia Sinica, Taipei, Taiwan at the Institute of Atomic and Molecular Sciences. Then In 1996 he was W F James professor of pure and applied science at the St. Francis Xavier University in Nova Scotia, Canada. Since 1980 he have been active in the field of laser induced chemistry and the emission spectroscopic studies of laser generated plasmas. In 2006 he retired but remained active at my former institute, the Central Research Institute of Chemistry as science advisor emeritus. Since 3 years he associated with the Research Center of Natural Sciences of the Hungarian Academy of Sciences, Budapest, as emeritus science advisor. His CV has been published by several international biographical organs, first in 1981 in the Who's Who in the World, , USA, then in several other published works, e.g. in the UK. A compilation of about 80 of his scientific papers are available at research gate.

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