

Mid-infrared emission spectroscopy of laser generated carbon plasmas

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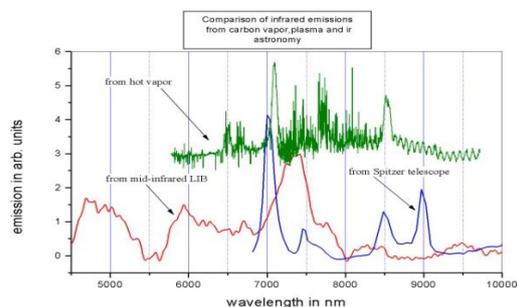
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Abstract

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 C₂) 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.

Image



Biography

Laszlo Nemes is graduated as certified Chemical Engineer in 1959 from the Technical University of Budapest. He joined the research network of the Hungarian Academy of Sciences and has been associated ever since with that organization. His main fields are molecular spectroscopy, laser and plasma spectroscopy. He did PhD from the Technical University of Budapest, 1965 and a DSC from the Hungarian Academy of Sciences, Budapest, 1982. He is habilitated, Titular Professor in Physical Chemistry at the Technical University of Budapest (1995). He has done research work in many countries (USA, Canada, UK, Germany France, The Netherlands, and Taiwan) and has published over 85 scientific papers in peer reviewed journals. He has edited book chapters and a book, also have written book chapters and a book. His present status is Science Adviser emeritus at the Research Center of Natural Sciences, Hung. Acad. Sci.

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