

主 論 文 要 旨

論文題名

Synthesis of polyynes by liquid-phase laser ablation

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主論文要旨

Polyynes are linear carbon-chain compounds with a sequence of alternating triple and single carbon bonds. In my thesis, polyynes of C_4H_2 – $C_{30}H_2$ are reported to be prepared by the liquid-phase laser ablation of a graphite pellet or rod.

Long-chain polyynes up to $C_{30}H_2$ were prepared from decalin and graphite using laser beam of 1064 nm, and detected using chromatograms and UV-Vis absorption spectra for the first time. On the other hand, short-chain polyynes of C_4H_2 and C_6H_2 prepared simultaneously were identified not by UV-Vis spectra but by MS because these polyynes have absorption peaks at short wavelengths below 200 nm.

Polyynes were also prepared from pellets of polycyclic compounds, such as 3,4,9,10-perylene tetracarboxylic dianhydride (PTCDA). The amounts of polyynes produced from PTCDA strongly depended on the polarity of the solvent, while those from graphite did not. This is believed to be caused by polar acid-anhydride side chains in PTCDA.

Polyynes were prepared from methanol and a pellet target of fullerene for the first time using laser beams of 1064 and 532 nm. The amounts of polyynes produced were greatest with the beam of 1064 nm. This result is different from the previous report using the fullerene powder target. It is suggested that the wavelength dependence in the preparation of polyynes with the pellet target differs from that with the powder target, since the main polyyne-production area in the solution is different.

Polyynes have been prepared and kept mostly in the liquid or vapor phase to date, therefore their preservation in solids may be difficult. Polyynes are unstable under ambient conditions in air, and attempts to stabilize them will therefore be important. To immobilize polyynes into the solid phase, polyyne containing SiO_2 dried gel was prepared using a sol-gel method, and the existence of polyynes in the gel was confirmed by measuring the UV-Vis absorption spectrum.