

Properties and space exposure of Quenched Nitrogen-included Carbonaceous Composite (QNCC)

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Organics are abundant in the present universe. However, we have limited knowledge on their origin and how they have contributed to life in solar system. The Unidentified Infrared (UIR) bands are ubiquitously seen in the various astronomical environments and should be important signals to understand how the primitive form of organics has emerged in the universe because the carriers of the bands are generally believed to be organic species. We have, for the first time, succeeded in synthesizing laboratory organics called Quenched Nitrogen-included Carbonaceous Composite (QNCC) whose infrared properties successfully reproduce the characteristics of the UIR bands observed around classical novae. We have found that N/C ratio (atom) of QNCC is 3-5% based on the measurement with Elemental Analyzer/Isotope Ratio Mass Spectrometer (EA/IRMS). X-ray Absorption Near Edge Structure (XANES) analysis of QNCC have indicated that amine (C-N) structures are contained in the QNCC. We have concluded that amine structures contribute to the broad feature around $8\mu\text{m}$ which characterize the UIR bands observed around classical novae. The broad band around at $8\mu\text{m}$ seen in infrared absorption spectra of QNCC is also seen in those of insoluble organic matter (IOM) in carbonaceous chondrites. N/C ratio of QNCC is almost consistent with that of IOM (2-5%). Therefore, QNCC is an important material to investigate the origin of primitive organics in solar system.

Based on above results we have launched a new space exposure experiment of QNCC using ExHAM (Exposed Experiment Handrail Attachment Mechanism) on the International Space Station (ISS) / Japanese Experiment Module 'Kibo'. This space exposure experiment aims to verify the hypothesis that organics which originates in evolved stars have delivered and contributed to primitive organics in solar system by investigating the changing in properties of QNCC exposed in solar neighborhood space environment and comparing with those of organic matter contained in meteorites. In this presentation, we will report the nature of QNCC which is the strong candidate of the carriers of the UIR bands observed around classical novae and the latest progress of space exposure experiment of QNCC.