Laboratory Simulation of the Formation and Destruction Processes of Extraterrestrial Carbonaceous Materials. C. S. Contreras[1] and F. Salama[1], [1]NASA Ames Research Center, Space Sciences and Astrobiology Division, MS 245-6, P.O. Box 1, Moffett Field, CA, USA 94035-0001, cesar.contreras@nasa.gov, farid.salama@nasa.gov.

Introduction: The study of the formation and the destruction processes of cosmic dust is essential to understand and to quantify the budget of extraterrestrial organic molecules. Although dust with all its components plays an important role in the evolution of interstellar chemistry and in the formation of organic molecules, little is known on the formation and destruction processes of carbonaceous dust. PAHs (broadly defined) are important chemical building blocks of interstellar dust. They are detected in interplanetary dust particles (IDPs) and in meteoritic samples. Additionally, observational, laboratory, and theoretical studies have shown that PAHs, in their neutral and ionized forms, are an important, ubiquitous component of the interstellar medium. Therefore, it is imperative that laboratory experiments be conducted to study the dynamic processes of carbon grain formation from PAH precursors. Studies of interstellar dust analogs formed from a variety of PAH and hydrocarbon precursors as well as species that include the atoms O, N, and S, have recently been performed in our laboratory under conditions that simulate interstellar and circumstellar environments. The species formed in the pulsed discharge nozzle (PDN) plasma source are detected and characterized with a high-sensitivity cavity ringdown spectrometer (CRDS) coupled to a Reflectron time-of-flight mass spectrometer (ReTOF-MS), thus providing both spectroscopic and ion mass information in-situ. We report the first set of measurements obtained in these experiments. Studies with hydrocarbon precursors will show the feasibility of specific molecules to form PAHs, while those that contain carbon ring systems (benzene and derivatives, PAHs) provide information on pathways toward larger carbonaceous molecules. In addition, comparison between heteroatom PAHs versus the homogenous PAHs and their ion products will be discussed. From these unique measurements, we derive information on the size and the structure of interstellar dust grain particles, the growth and the destruction processes of interstellar dust and the resulting budget of extraterrestrial organic molecules.

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