Co-condensation of Atomic and Molecular Precursors of Silicate and Carbon Grains at Cryogenic Temperatures

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The existence of cosmic dust gives rise to questions regarding its formation, its evolution, and its destruction. During this life cycle, each stage sees complex chemical and physical mechanisms at work. We recently started to study the formation and growth of cosmic dust grains under conditions relevant to the interstellar medium, i.e., at cryogenic temperatures. In the case of silicate grains, we found that cryogenically-cooled atomic and molecular precursors could react to form a solid condensate consisting of aggregated nanometer-sized particles. As the process did not require external energy, this result implies that the condensation of silicates can proceed by means of barrierless chemical reactions. Similar experiments with carbonaceous precursors led to the formation of amorphous carbon condensates. Thus silicate grains as well as carbon grains can grow in the interstellar medium and, as a consequence, one would expect the growth of mixed grains as carbon precursors are present in all interstellar regions. Observations, however, suggest that cosmic dust grains are either siliceous or carbonaceous, not both. Our current laboratory work aims at shedding light on the separation of siliceous and carbonaceous cosmic dust. The latest results of our experiments on the formation of cosmic dust grains at cryogenic temperatures will be presented and discussed.