The Growth of Grains in the Interstellar Medium: Experimental Evidences

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Astronomical observations consistent with the growth of interstellar dust grains by accretion of gas-phase species are growing in number. They motivate the development of models that describe this stage in the life cycle of cosmic dust, and consequently laboratory experiments to determine the value of the parameters used by these models.

Our group is carrying out experiments on the condensation of refractory solids at temperatures relevant to the ISM. We have found that atomic and molecular species could react at cryogenic temperatures ($\leq$ 13 K) and accrete into solid, amorphous grains, without the need for an external source of energy. Thus were formed aggregates of SiO grains (Rouillé et al. 2013, Krasnokutski et al. 2014) and also aggregates of complex silicate grains (Rouillé et al. 2014), which exhibited a 10 μm absorption band similar to the corresponding feature attributed to interstellar silicate grains.

Consecutively we have started experiments on the co-condensation of atomic and molecular precursors of silicate and carbonaceous grains. Our goal is to determine whether the precursors would condense into mixed compounds or into separate phases. First experiments have shown that the co-condensation of $(SiO)_k$ ($k \geq 1$) and C_n ($n \geq 1$) leads to the formation of amorphous SiO grains that give rise to the typical 10 μm feature. The SiO grains show some signs of disproportionation with the presence of silicon nanocrystals $\approx$2 nm in size. The separate carbon phase of the condensate is also amorphous. The results of our latest experiments, which involve atomic and molecular precursors of a magnesium silicate together with C_n species ($n \geq 1$), will be presented and discussed.

Reference

Krasnokutski, S. A., Rouillé, G., Jäger, C., Huisken, F., Zhukovska, S., & Henning, Th. 2014, ApJ, 782, 15

Rouillé, G., Jäger, C., Krasnokutski, S. A., Krebsz, M., & Henning, Th. 2014, Faraday Discuss., 168, 449

Rouillé, G., Krasnokutski, S. A., Krebsz, M., Jäger, C., Huisken, F., & Henning, Th. 2013, in The Life Cycle of Dust in the Universe: Observations, Theory, and Laboratory Experiments, ed. A. Andersen, M. Baes, H. Gomez, C. Kemper & D. Watson, PoS(LCDU 2013)047