Properties of carbon soot

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Carbonaceous grains constitute a large fraction of the cosmic dust population. They originate in stellar objects where carbon particles are formed by the nucleation and condensation of gas-phase precursors. According to observations, carbon grains are produced by evolved carbon-rich stars of the Asymptotic Giant Branch sequence and by core-collapse supernovae. They are also produced in carbon-rich Wolf-Rayet stars. To these different stellar objects correspond different conditions in which the stellar soot is produced, affecting its properties.

The formation mechanism of stellar soot, especially the essential step of nucleation, is not well known. It has been studied experimentally by our group by reproducing in the laboratory the conditions of carbon-rich stellar environments [1-5]. The analysis of the soot synthesized in the experiments, such as the sample shown in Figure 1, has allowed us to relate its physical and chemical properties with the conditions in which it was formed. The results obtained for these laboratory analogs of stellar soot have provided us with clues as to the formation mechanism and the properties of the actual material. Our studies and their conclusions will be reviewed.

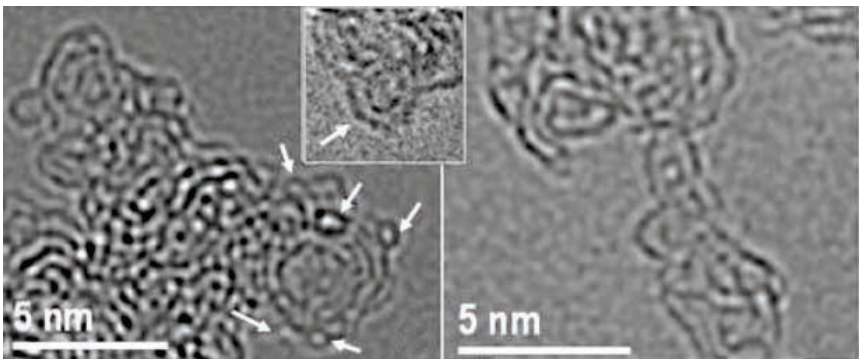

Figure 1: High-resolution transmission-electron-microscopy images of fullerene-like carbon nanoparticles generated in a high-temperature condensation process. Arrows point at fullerene molecules [4].

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References

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