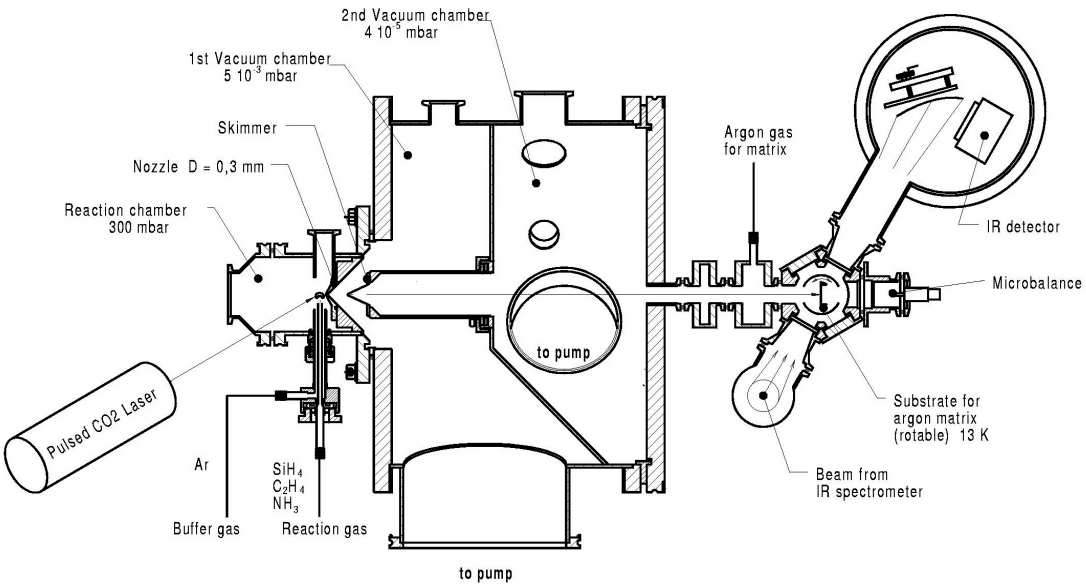
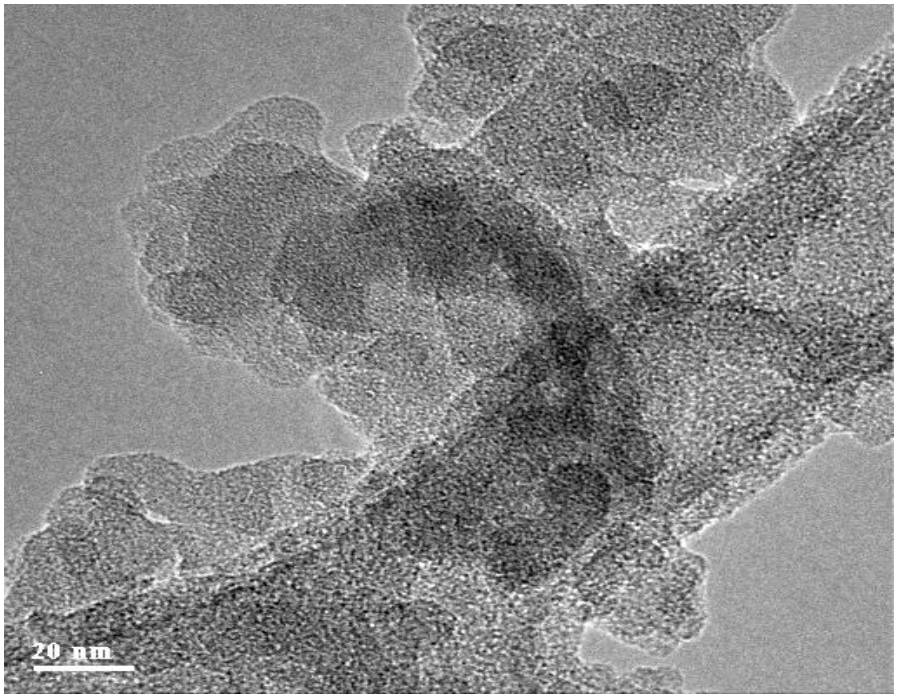
Carbon Nanoparticles

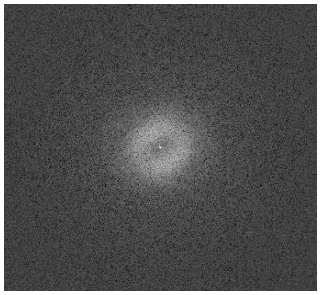
Dr. Harald Mutschke, Prof. Dr. Th. Henning, Dr. Cornelia Jäger, Isabel Llamas Jansa,

We have studied the spectroscopic and structural properties of amorphous-carbon nanoparticles produced by laser induced pyrolysis of acetylene gas (see a sketch of the apparatus below).



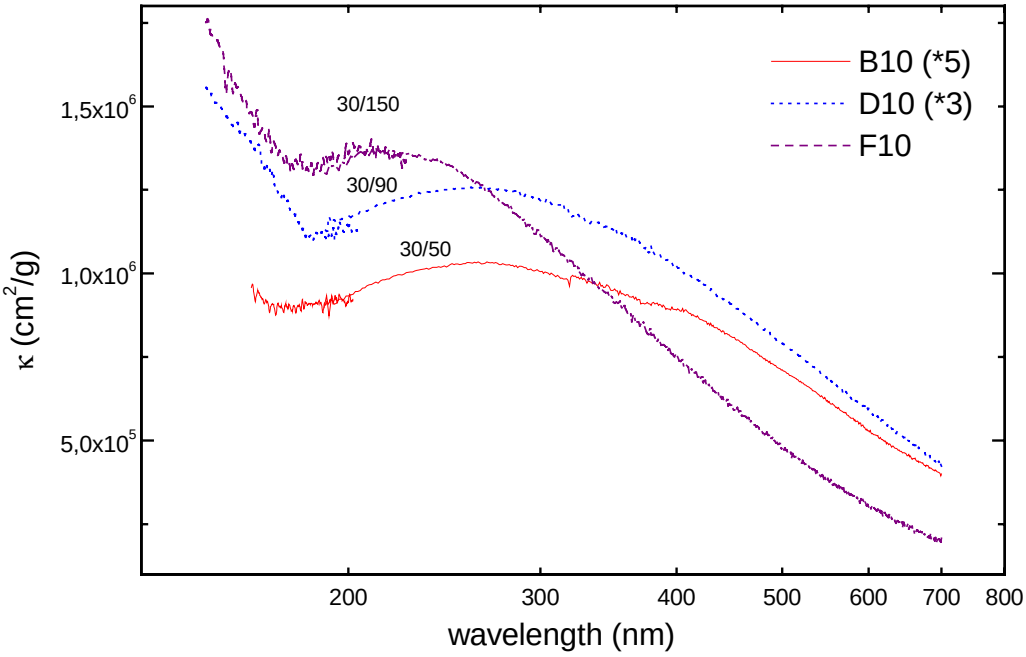
The particles are about 10nm in size and amorphous. High-resolution electron microscopy reveals curved layers of sp^2-hybridized carbon but no crystalline structural components, see also the diffraction pattern.

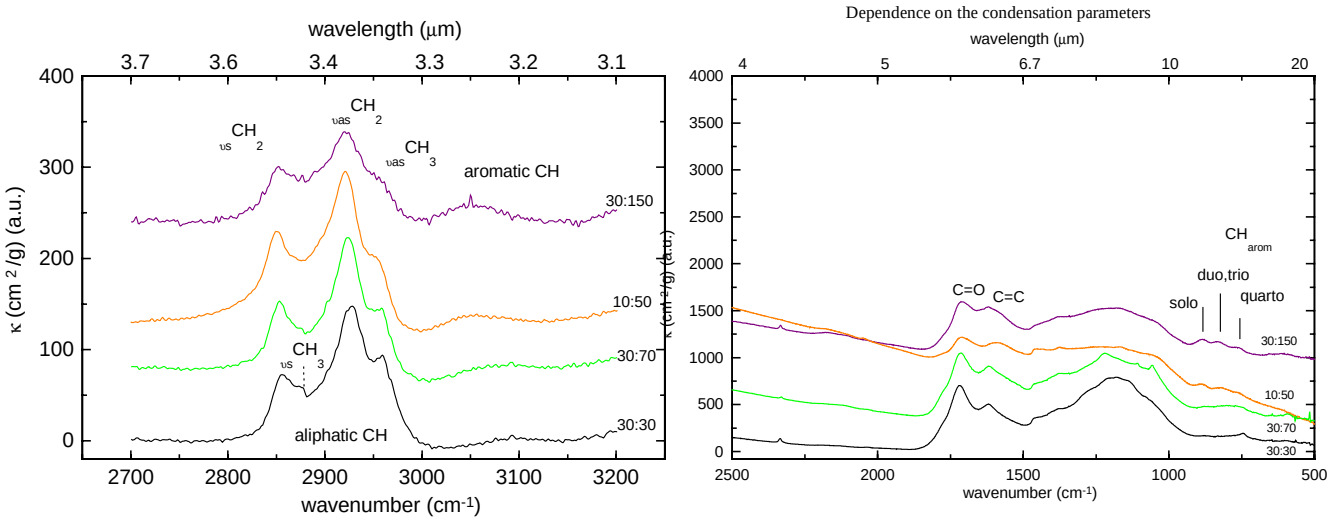




Optical spectroscopy of these particles gives information about the band structure (in the UV), the conductivity, the content of hydrogen and oxygen, and the aromatic/aliphatic character of the material (in the IR).
To avoid contamination at the one hand and agglomeration at the other hand, we can measure the particles in-situ, embedded in a noble-gas matrix.

The spectroscopic properties depend mainly on the condensation temperature which is both a function of the flow velocity in the gas reactor and the amount of laser energy absorbed. The latter is controlled by the admixture of a photo-sensitising gas (SF_6). The graphs below show UV and IR spectra measured for different ratios of SF_6 to C_2H_2.





The comparison with emission spectra observed in the outflows of evolved stars shows a coincidence of bands produced by circumstellar carbon dust with those of our analogue material.

Comparation with the ISO SWS01 data from IRAS 22272+5435 and IRAS 07134+1005