IR spectroscopy of matrix-isolated oxide nanoparticles

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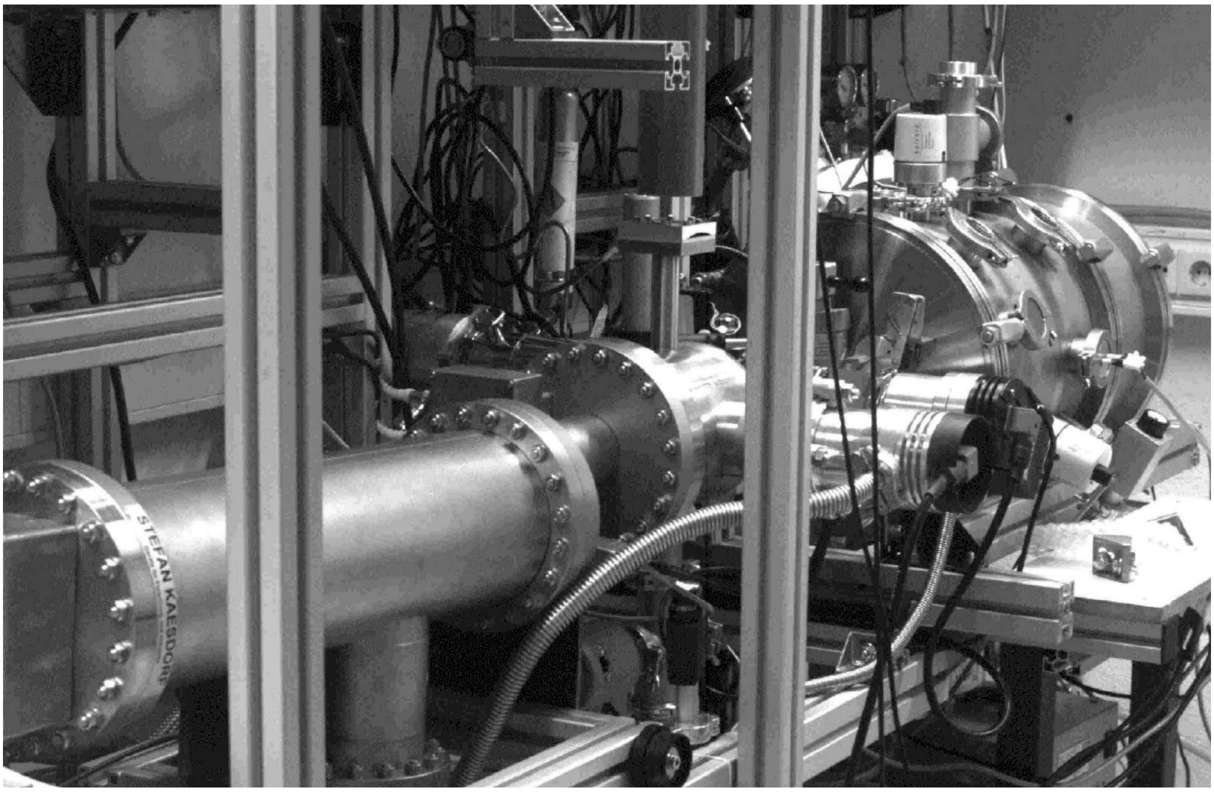
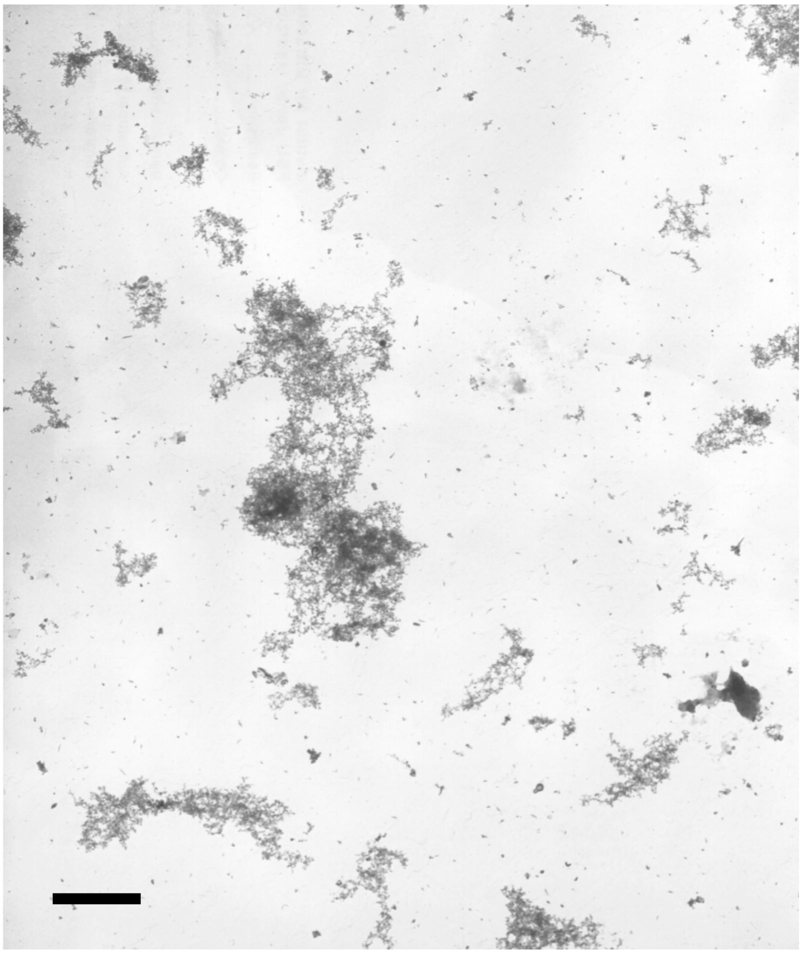
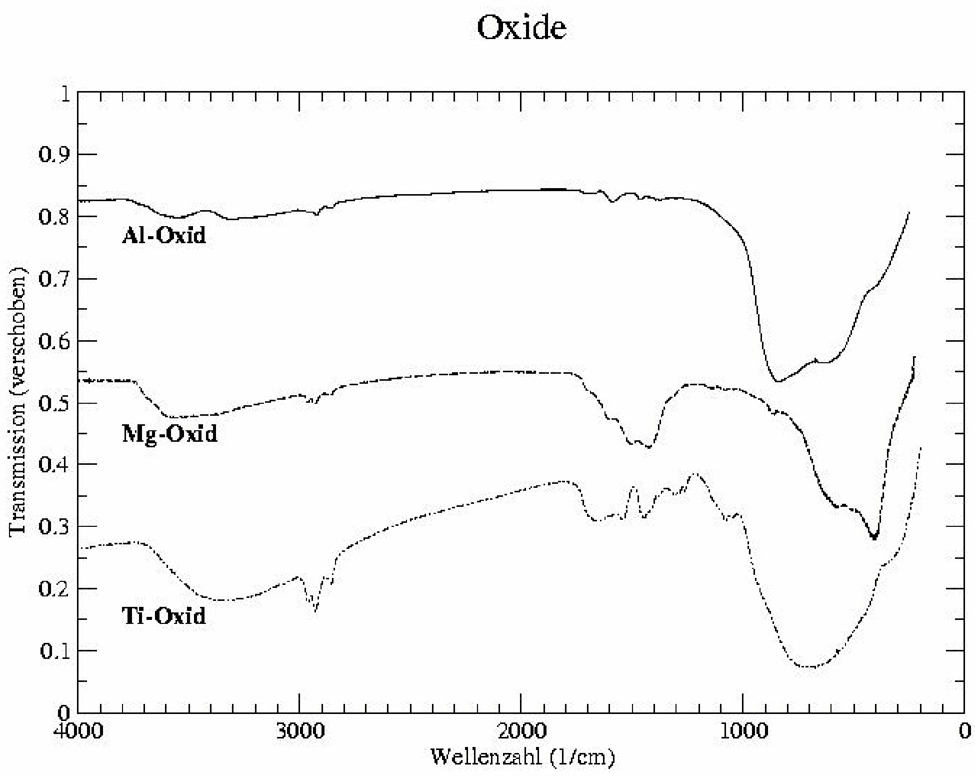
The project is intended to study the influences of particle shape, agglomeration, and surrounding medium on the infrared spectra of oxide particles. We produce these particles by laser ablation of metal targets in oxygen atmosphere at different pressures. For measuring the infrared spectra, the nanoparticles are isolated in a noble gas matrix. (see a photo of the apparatus below).



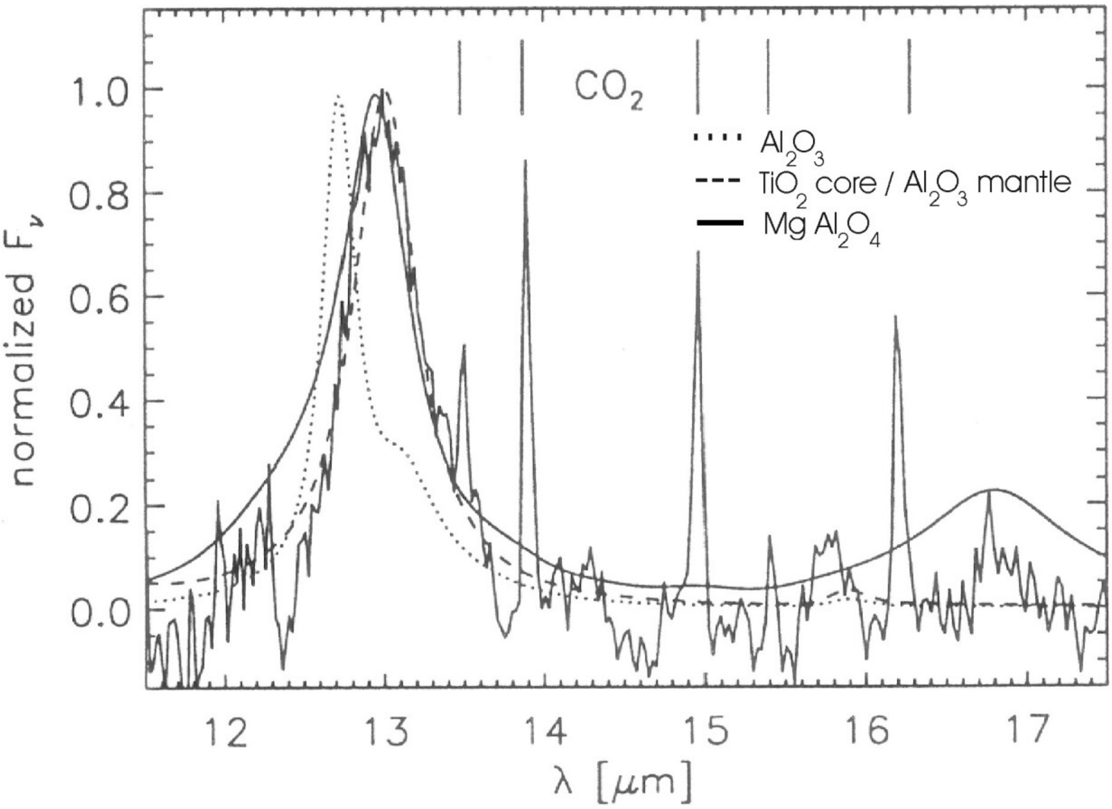
The particles are about 10nm in diameter. Depending on the pressure regime, they form aggregates of different size or single particles. The scale bar in the TEM image below corresponds to a scale of 1.2 micron.



First spectra of aluminium, magnesium, and titanium oxide particles produced by our method show broad absorption bands in the spectral range between 900 and 400 cm^{-1} in wavenumber corresponding to 11-25µm in wavelength.



The details of band positions and profiles and their dependence on the above-mentioned effects play an important role in the interpretation of astronomical spectra observed e.g. in emission from AGB stars.



CO2
Al2O3
TiO2 core / Al2O3 mantle
Mg Al2O4
normalized Fν
λ [μm]
1.0
0.8
0.6
0.4
0.2
0.0
12
13
14
15
16
17