Chirped pulse spectrometer operating at 200 GHz

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The use of the sub-mm/Terahertz (SMM/THz) band (0.1 to 10 THz) for the analysis of gas phase systems is attractive due to a vast number of light polar compounds which produce strong rotational spectra. In particular, at low pressure, the molecular linewidths approach the Doppler limit and the narrowness of the spectral features ensures that an excellent selectivity can be achieved even in complex mixtures. In order to exploit these features considerable attention has been paid to the technological development of radiation sources able to operate in this regime. At present, only amplified multiplier chains (AMC) and photomixer (PM) sources are practicable when high-resolution spectra are required for the analysis and quantification of gas phase species.

A new technique employing a MW Chirped-Pulse (CP) has recently been developed (Dian et al 2008). A coherent emission is produced by the sample, a process termed Free Inductive Decay (FID). The FID can be recorded after the end of the excitation pulse overcoming the difficulties of the absorption configuration. The intensity of the FID decays as the sample gradually dephases and returns to its unpolarised state. Powerful MW solid state or traveling wave tube amplifiers are now available enabling the development of faster techniques such as CP spectroscopy where no mechanical scanning is required. The strategy employed in this case is to record the phase coherent FID with the largest possible bandwidth, the signal to noise ratio is optimised by temporal accumulation. This has the advantage of being a multiplex approach, by recording the time dependent FID and taking the Fast Fourier Transform (FFT), the entire instrument bandwidth is obtained simultaneously.

A chirped Pulse sub-millimetre (CP-SMM) spectrometer as been develooped in Dunkirk in the 190-210 GHz region. Experimental setup will be described with its optimization for spectroscopy research or molecular detection.

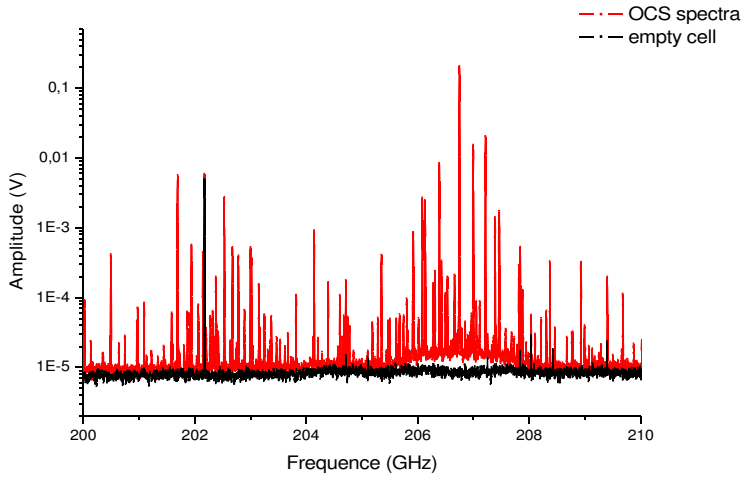

Fig.1. 70 µbar OCS spectra recorded in 40 sec in 55 cm cell.

Reference :
[1] Dian, B.C., Brown, G.G., Douglass, K.O., Pate, B.H. Measuring picosecond isomerization kinetics via broadband microwave spectroscopy (2008) Science, 320 (5878), pp. 924-928.