GAS-SURFACE INTERACTION IN THE SOLAR NEBULA: CONTRIBUTION OF THE PRONEXT INSTRUMENTATION. Z. Djouadi1, J. Borg1, L. d’Hendecourt1, D. Deboffle1, D. Baklouti1, C. Depecker and H. Leroux1, 1“Astrochimie et Origines”, Institut d’Astrophysique Spatiale, Orsay (France), 2LSPES, Université de Lille 1, Villeneuve d’Ascq (France) Email: janet.borg@ias.u-psud.fr

Introduction: In the last years, and, more particularly, since the return of the Stardust mission and the analyses of returned cometary material, a better understanding of the evolution of the minerals present in the Solar nebula in its first million years starts to emerge [e.g., 1;2]. These recent discoveries tend to reinforce the radial mixing model, as theoretically suggested by [3]. A possible comparison between the various extraterrestrial grains, present as primitive material and now available for analysis in the laboratory, shows a complex mineralogy for these grains. In particular, while interstellar silicate grains, as well as “Stardust” grains are found to be mainly anhydrous, numerous phyllosilicates are found in primitive meteorites [4]. One interpretation of this evolution of minerals when entering the nebula may be found in the metamorphism of the grains under the specific physical conditions prevailing in the nebula (pressure, temperature, gas composition or irradiation).

Experimental description: With the development of the PRONEXT (PRocessus Nébulaires à la surface des grains EXTraterrestres) experiment, we intend to study experimentally the evolution of grain surface analogues, when subjected to a controlled heating, under a particular atmosphere. The aim is to understand the mineralogical evolution that may have taken place in the Solar nebula, by simulating gas-surface interactions with nebular gases. PRONEXT is a high pressure/high temperature [300K, 1000K] commercial environmental cell for which IR spectroscopy will deliver the main in-situ information, with the adaptation to a FTIR spectrometer VERTEX 70, working in the [7000-400 cm⁻¹] range. In a second step, Transmission Electron Microscopy measurements will give a clear identification of the minerals evolution.

The main objective of this experimental approach is to study the kinetics of some reactions, particularly the ones of hydration and carbonate formation from amorphous silicates surfaces in interaction with H₂/H₂O/CO₂ atmospheres and deduce kinetic constraints for evolution time scales in the nebula, prior to parent bodies formation as discussed in [5].

We will present a description of the experimental set-up and discuss some preliminary results.