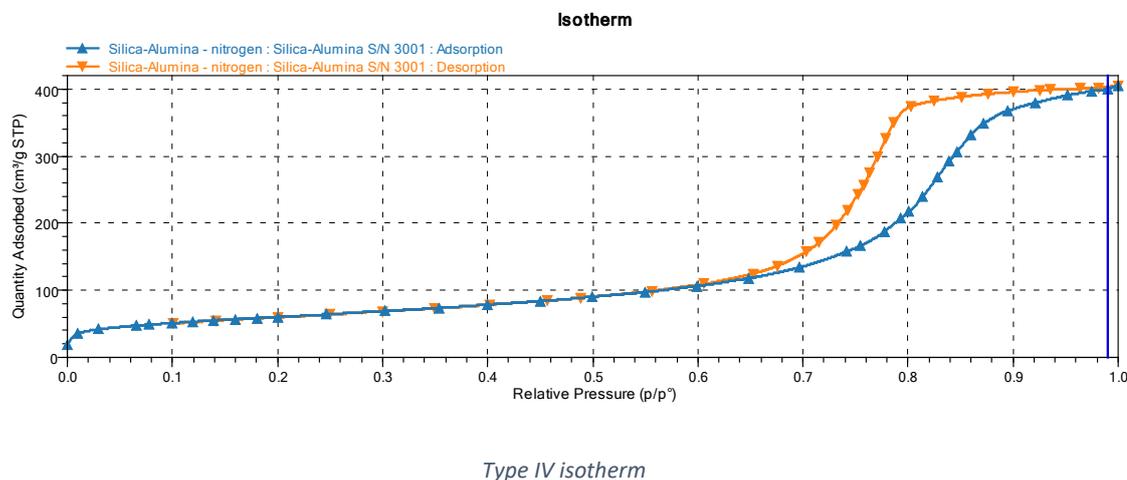


## Purpose and principle

Determine the specific surface area using the Brunauer, Emmett and Teller 'BET' method, as well as the porosity (pore size distribution and pore volume) of a solid material.

The quantity of nitrogen adsorbed - desorbed (physisorption) by the solid at the temperature of liquid nitrogen (77K) as a function of the relative pressure ( $P/P_0$ ), between  $10^{-3}$  and 1, is called the adsorption-desorption isotherm.



This isotherm can be used to determine :

- the specific surface area (in  $\text{m}^2/\text{g}$ ) of said solid by applying the BET model:
  - at  $0.05 < P/P_0 < 0.3$  for a mesoporous material ( $2 \text{ nm} < d_{\text{pore}} < 50 \text{ nm}$ )
  - at a lower  $P/P_0$  range determined using the Rouquerol BET for samples with very low porosity (low specific surface area)
- porosity over the entire adsorption-desorption isotherm obtained

## Technical specifications

- Equipment:
  - MICROMERITICS Tristar and Tristar II+ analysers
    - Possibility of carrying out up to 3 simultaneous analyses per Tristar instrument
  - MICROMERITICS VacPrep061 degassing station
    - Possibility of degassing 6 samples simultaneously at a temperature of up to  $450^\circ\text{C}$  (one temperature for all samples)
- Mesoporous solid:  $2 \text{ nm} < d_{\text{pore}} < 50 \text{ nm}$
- Adsorbate :  $\text{N}_2$
- $P/P_0$  :  $10^{-3}$  to 1
- Analysis temperature: 77K (liquid nitrogen temperature)

### Gas Adsorption Theory

Presented by Micromeritics Instrument Corporation

**Microscopic View**



Gas adsorption is a reversible process. The gas molecules are attracted to the surface of the solid and form a thin layer on the surface. The thickness of the adsorbed layer depends on the pressure of the gas and the temperature of the solid.

**Surface Area**

Surface area is the total area of the solid surface that is available for adsorption. It is measured in square meters (m<sup>2</sup>). The surface area of a solid is determined by the size and shape of the particles that make up the solid.

**Porosity**

Porosity is the volume of the void spaces (pores) within a solid. It is measured in cubic centimeters (cc). The porosity of a solid is determined by the size and distribution of the pores.

**Characterization Techniques**

Gas adsorption is a common technique for measuring surface area and porosity. It involves measuring the amount of gas that is adsorbed onto a solid at different pressures and temperatures. The resulting data is used to calculate the surface area and porosity of the solid.

**Applications**

Gas adsorption is used in a wide variety of applications, including the study of catalysis, the development of new materials, and the characterization of existing materials. It is also used in the design of adsorbents for air and water purification.

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Tristar



*Tristar II+*



*VacPrep 061*

## **Analysis conditions / sample submission**

- Sample = degassed powder stable under vacuum and temperature
  - Anticipate degassing conditions (humidity and potentially other gases adsorbed on the surface of the solid)
- Sample quantity: between 50 mg and 200 mg
- Use of glass tubes and rods for analysis:
  - ICPEES: At the charge of the different teams, references available from Fabrice VIGNERON
  - External: Use of those from the plateau
- Standard analysis (duration: a few hours) = day or overnight booking possible

## **Contact and location**

Our equipments for specific surface area and porosity analysis are available to both academic and industrial teams. The analysis department is located on the 1st level of building 104 (R4) in laboratory 3.

- Scientific Referee: [Dominique BÉGIN](#)
- Technical and training Referee: [Fabrice VIGNERON](#)

For information on how to access the department and its equipment, please contact the department referees.

For all requests for analysis (external) or training (internal), download the form below and return it to the department referees.

- **Formulaire de demande d'analyse/de formation - FR**
- **Analysis/training request form - EN**