

Chapter 2

Objectives and Research Approach

Considering the above-mentioned issues, our goal is to identify the key parameters enhancing the adsorption of ammonia and thus enable the design of efficient ammonia adsorbents adapted to real-life conditions. In other words, the adsorbent performance must be increased compared to those reported in the literature. The retention of ammonia must be strong so that no desorption of the gas occurs overtime. And finally, the adsorbent must be able to adsorb and retain ammonia at room temperature over a wide range of humidity levels to ensure its industrial sustainability.

To “built the ideal ammonia adsorbent”, one has to consider the two main conditions for the good adsorption and sustainable retention of ammonia on solid surfaces and try to meet these requirements. One of them is related to physisorption and implies the use of an adsorbent with very small pores, similar in size to that of ammonia molecule. This enhances the physical forces between the pores walls and the molecules to be adsorbed. A second condition is the involvement of chemical transformations (reactive adsorption) of ammonia. Considering the chemistry of this molecule, reactions such as hydrogen bonding, acid–base reactions, and complexation can be envisioned.

The research approach proposed in this study to achieve the above objectives is summarized as follows:

- Synthesis of various materials with porosity and surface chemistry features expected to enhance the strong adsorption of ammonia under ambient conditions.
- Test of the materials prepared for ammonia removal in dynamic conditions, at room temperature, in dry and moist conditions (to assess the potential of the materials for practical applications).
- Study of the strength of ammonia retention.
- Characterization of the adsorbents (textural parameters, porosity and surface chemistry) by various techniques before and after ammonia adsorption.
- Identification of the factors influencing ammonia uptake.
- Proposal of the mechanisms of ammonia retention.

The findings obtained considering this research approach are presented in the following chapters. In [Chap. 3](#), the preparation of the materials tested is described as well as the techniques used to characterize them and to test them for ammonia adsorption. [Chapter 4](#) provides an overview of the materials performance for ammonia removal in terms of adsorption capacity and strength of retention. The role of textural parameters, surface chemistry and moisture is presented in detail in [Chap. 5](#), [Chap. 6](#) and [Chap. 7](#), respectively. A summary on the different mechanisms of ammonia adsorption/retention can be found in [Chap. 8](#). Finally, [Chap. 9](#) offers a conclusion on this research project while [Chap. 10](#) suggests some new paths for future research on ammonia removal from air.