Understanding of ammonia absorption of magnesium chloride supported porous materials

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Highlights

- Preparation of magnesium chloride supported on porous supports by wet impregnation
- The influence of supports on ammonia absorption capacity
- Evaluation of the material stability

1. Introduction

Ammonia is gaining recognition as a promising green energy vector of the future, especially due to its high energy density and carbon neutrality. The biggest challenge, however, remains a more efficient production of ammonia from abundant, but intermittent renewable sources.[1] In the conventional ammonia synthesis, ammonia is separated by a condenser, which is energy-intensive.[7] Therefore, an important aspect of improving ammonia synthesis is by efficiently separating ammonia by solid absorbents prior to the recycle. Recently, several materials have been proposed as a solid media for ammonia separation, among which metal halides seem to be the most viable option, by coordinatively absorbing ammonia.[12] In this work, bulk magnesium chloride, as well as magnesium chloride supported on porous supports were investigated in terms of ammonia capacity.

2. Methods

$MgCl_2$ on different supports was synthesized by the wet impregnation synthesis technique in an inert atmosphere. The as synthesized material was characterized by different characterization techniques for physico-chemical properties, including XRD, SEM-EDS, and BET. Temperature-programmed desorption was used to determine ammonia absorption capacity of different materials.

3. Results and discussion

Aiming to determine the ammonia absorption capacity of a metal halide, the wet impregnation synthesis method was used to impregnate different supports with metal halide. Bulk $MgCl_2$ was also characterized in order to compare it to the supported one. It was found that though metal halide is the material absorbing ammonia, the support has a significant effect on the ammonia absorption capacity due to different BET surface areas, enabling different dispersions of a metal halide, preventing the agglomeration of a halide. Further, the stability is also improved when metal halide is supported in comparison to bulk halide. In Figure 1, the SEM image of the sample can be observed, which shows a bulk magnesium chloride.

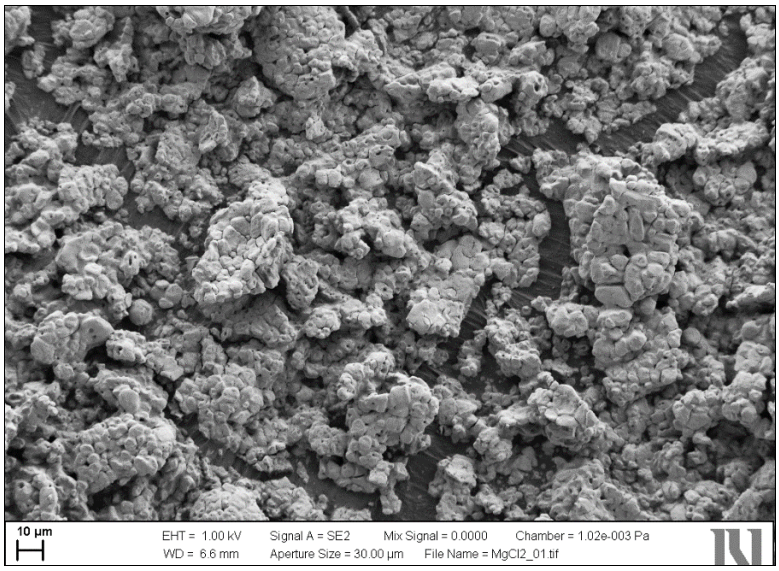

Figure 1. SEM image of a bulk magnesium chloride.

4. Conclusions

Magnesium chloride on different supports was successfully prepared by a wet impregnation method, and was characterized by different characterization techniques. According to the obtained ammonia capacity of different materials, the support has a significant impact on the ammonia capacity. The results indicate the applicability of the synthesized sorbent in ammonia separation process, for instance in integrated ammonia synthesis – separation process.

References

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Keywords
ammonia separation; metal halides; green energy; temperature-programmed desorption