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Pressurized synthesis of composite carbon foams based on calcium salts

Florina Stefania Rus[1], Cristina Mosoarca[1], Nicolae Birsan[1], Radu Banica[1]

[1]National Institute of Research and Development for Electrochemistry and Condensed Matter (INCEMC), Timisoara, Romania

INTRODUCTION & AIM

This study proposes an innovative and ecological approach for the synthesis of carbon-containing composite foams from glucose through thermal decomposition under pressure. Calcium chloride reaction through foam treatment in CO_2- NH_3-H_2O vapors provides additional functions of the material. $CaCl_2$ conversion enables advanced gas absorption applications. These findings clearly demonstrate the material's capacity for effective absorption of both water vapor and volatile acids concurrently allowing their use as phase transformation materials (PCMs).

RESULTS & DISCUSSION

The porous and hydrophilic nature of the carbon foam increases the contact surface of the concentrated $CaCl_2$ solution-wet air interface, increasing the absorption speed of water vapors and simultaneously preventing the leakage of the formed liquid. $CaCl_2$:glucose mass ratio of samples S1, S2 and S3 are: 4 (S1), 1.5 (S2) and 2 (S3). The Fourier Transform Infrared analyses confirmed the compositional changes in the foam after CO_2 treatment. According to X-ray diffraction analysis, the formation of calcite as a single crystalline phase, can be clearly observed.

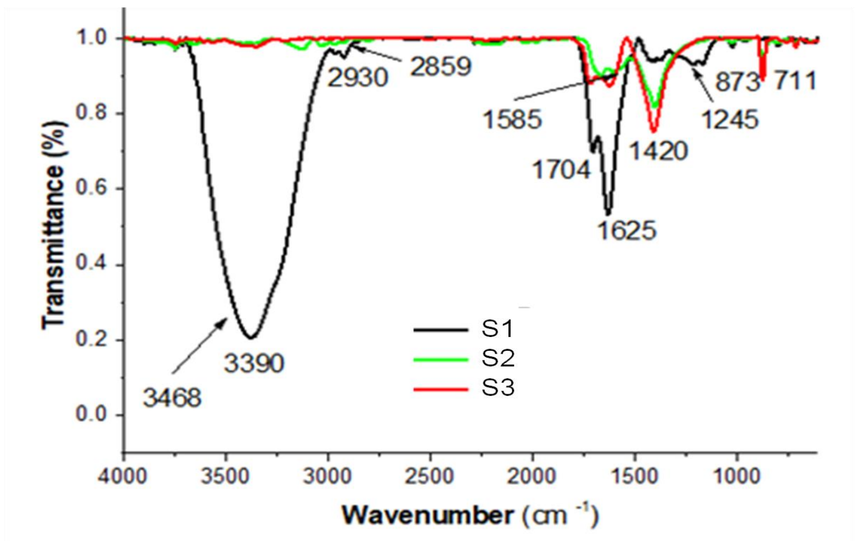

Figure 1. FTIR Spectra of Foam Samples S1, S2, and S3 corresponding to ammonia-treated and post-sublimation

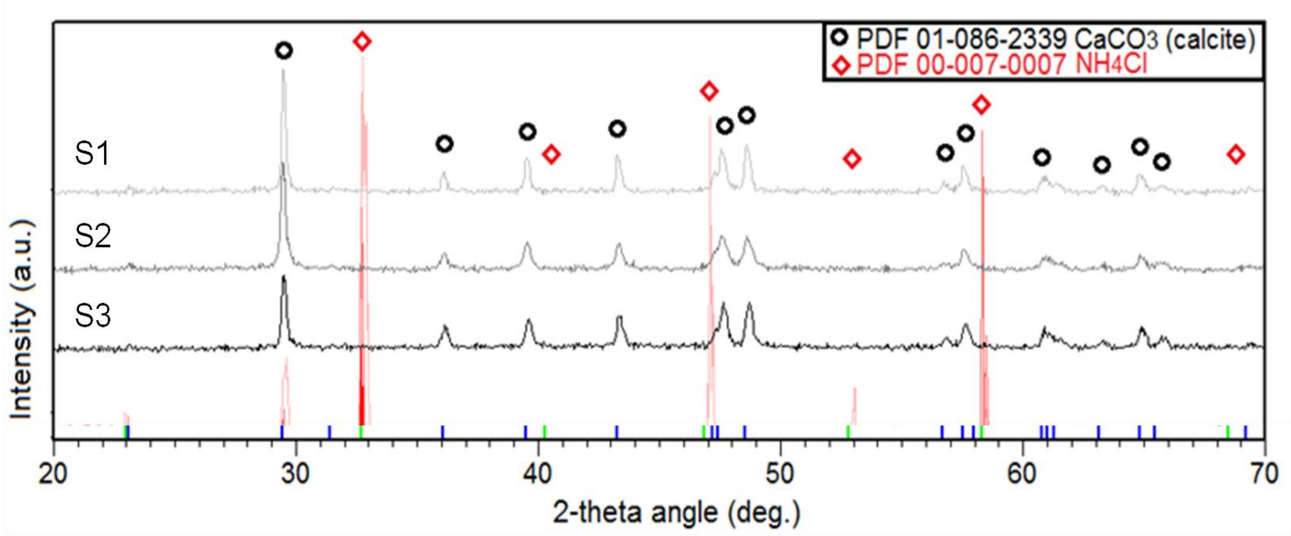

Figure 2. XRD spectrum for samples S1, S2 and S3

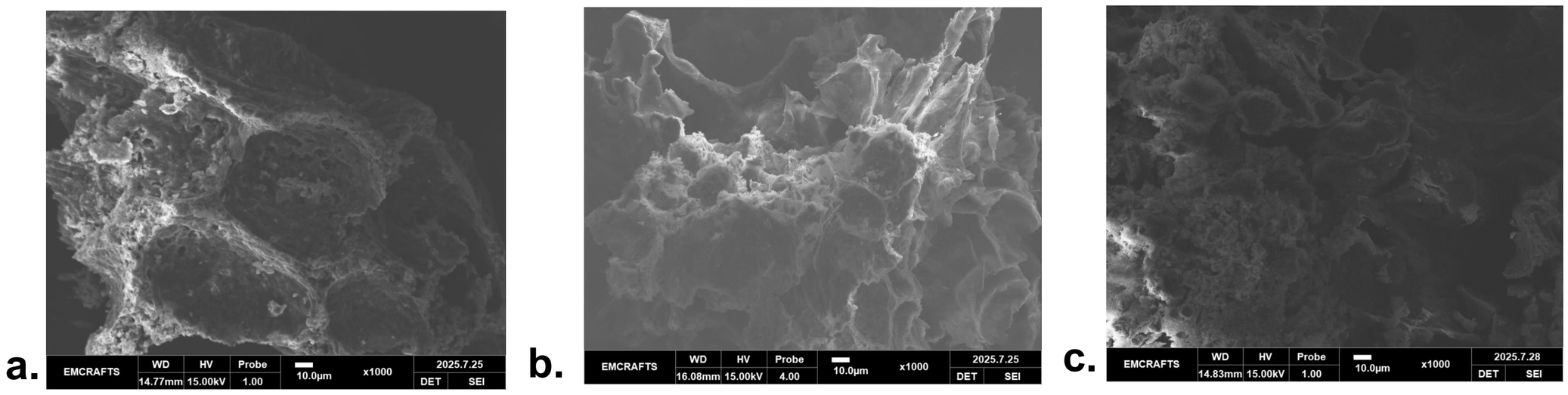

Figure 3. SEM images of the aerogels obtained for $CaCl_2$:glucose mass ratios of (a)S1 - 4; (b)S2 -1.5 and (c) S3 - 2.

CONCLUSION

- After prolonged heating of the foams initially treated in CO_2 and NH_3 vapors, no traces of NH_4Cl are detected, indicating its complete sublimation during the thermal treatment.
- The results obtained show that the carbon foams synthesized by this method have multiple uses, including different gas capture and thermal management.

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