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Desulphurization for PEM based micro-CHP application

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In PEMFC applications, organic and inorganic sulfur compounds are harmful for both reformer and electrodes catalysts, blocking the active sites for the reactions and causing a progressive performance drop [1–5]. Consequently, a clean-up section characterized by deep sulfur removal has to be implemented in natural gas fuel processing unit, to reduce sulfur fraction down to PEMFC tolerance limit (< 1 ppm) [6]. Among the main developed clean-up methods, adsorption technologies represent the most suitable solution for the studied application, because of the possibility to reach the required ultra-low sulfur levels with 100% efficiency and the use of systems operating at room temperature [7][8].

The used gas mixtures contain tetrahydrothiophene (THT), tert-butylmercaptan (TBM) and dimethylsulphide (DMS), which are the main odorants used in the typical European odorization blends. Activated carbons characterized by different surface treatments, activated impregnated alumina, iron oxide and natural zeolite have been tested previously for H2S adsorption under different operative conditions, allowing the possibility to compare the results in terms of inorganic and organic sulfur compounds removal.

In this project, sulfur clean-up through adsorption is studied and the performance of selected sorbents towards odorants removal is investigated under the variation of operating parameters, as Gas Hourly Space Velocity (GHSV), gas composition, temperature and filter geometry. The samples are characterized before and after the adsorption through B.E.T. analysis, evidencing the changes in their porous structure and the correlation with adsorption capacity results.

References

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