The study on zirconia based compound aerogel with controlling the rate of sol-gel reaction

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Zirconia has the good thermal stability, which may lead to potential applications at high temperatures. Hence, zirconia aerogel is one of good candidate for high temperatures thermal insulator. But zirconium has a higher ionic character and these fast reaction speeds and the difficulty in controlling the sol-gel reaction parameters, leads to a relatively lower surface area and porosity of the zirconia aerogel.

In this study, the synthesis of zirconia based compound aerogel attempted for enhancing zirconia aerogel properties. Phase separation control during alcogel synthesis is a critical aspect of this process, due to the different sol-gel reaction rate of two component aerogel. We effectively addressed this issue by controlling the sol-gel reaction parameters, to obtain a zirconia-based alumina aerogel with atomically bonded Zr-O-Al. This atomic bonding plays an important role in maintaining the pore structure of zirconia aerogels, during ambient pressure drying. The prepared aerogel inhibits pore structure collapse and helps to enhance the specific surface area. In addition, the thermal stability of the synthesized aerogel was improved compared to the zirconia aerogel. Both, the textural and physical properties, were also improved due to the formation of the compound with the alumina aerogel. Therefore, these aerogels are potentially useful for high-temperature thermal insulation applications due to their enhanced pore structure.

Keywords: compound aerogel; zirconia; alumina; sol-gel reaction rate

Acknowledgement: This work was supported by the National Research Foundation of Korea (NRF) grant funded by the Korea government(MSIT) (No. 2020R1A5A1019131). This work was supported by the Human Resources Development program (No. 20204030200110) of the Korea Institute of Energy Technology Evaluation and Planning(KETEP) grant funded by the Korea government Ministry of Trade, Industry and Energy.

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