Effect of diverse environmental conditions on the heat insulation and mechanical properties of nanofibrillated cellulose/polymethylsilsesquioxane aerogel

Pragya Gupta*, Pradip K Maji
Advanced Materials Research Laboratory, Department of Polymer and Process Engineering, Indian Institute of Technology, Roorkee (India)
**Email id: pgupta@pe.iitr.ac.in*

Abstract
In the current scenario, three dimensional and highly porous structure have high demand in energy-efficient building application due to its low thermal conductivity, hydrophobicity, and high mechanical properties. Recently, the energy-efficient building has gained much attention because it is devoted to passive energy-saving technique. Different concentrations of cellulose nanofibers/ sepiolite/polymethylsisesquioxane aerogels have been prepared via freeze-drying method. The aerogels reflected density ranges from 12-56 kg/m^3, 97-99.5% porosity, and thermal conductivity 22-29 mW/m K by varying sepiolite and molar ratio of methyltrimethoxysilane. Due to low density and high porosity, prepared foam termed as aerogel. Morphological analysis has been done via X-ray microtomography analysis to evaluate homogeneity and monolithic structure of aerogel [1]. The tensile test is carried out in a temperature and humidity control chamber at -15ºC, 10ºC, 25ºC, and 40ºC to evaluate the mechanical performance in different climatic conditions. There is a 140 times increment in tensile modulus after the addition of 20% sepiolite and 38% polymethylsisesquioxane with respect to 1.8 wt% CNF aerogel at 25ºC and 50%RH [2]. Modified aerogel reflected fivefold enhancement in storage and loss modulus, but the damping factor was constant during compression mode dynamic mechanical analysis. The contact angle analysis has shown the hydrophobic nature of aerogel; hence, it can be utilized as a building envelope as well.

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Reference

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