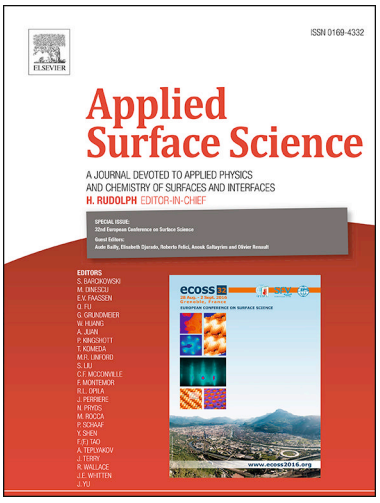
Accepted Manuscript



Full Length Article

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PII: S0169-4332(18)30144-2
DOI: https://doi.org/10.1016/j.apsusc.2018.01.132
Reference: APSUSC 38271

To appear in: *Applied Surface Science*

Received Date: 19 December 2017
Revised Date: 10 January 2018
Accepted Date: 14 January 2018

Please cite this article as: T. Wu, J. Dong, F. Gan, Y. Fang, X. Zhao, Q. Zhang, Low dielectric constant and moisture-resistant polyimide aerogels containing trifluoromethyl pendent groups, *Applied Surface Science* (2018), doi: https://doi.org/10.1016/j.apsusc.2018.01.132

Low Dielectric Constant and Moisture-Resistant Polyimide Aerogels Containing Trifluoromethyl Pendent Groups

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ABSTRACT: Conventional polyimide aerogels made from biphenyl-3,3′,4,4′-tetracarboxylic dianydride (BPDA) and 4,4′-oxidianiline (ODA) exhibit poor resistance to moisture and mechanical properties. In this work, a versatile diamine, 2,2′-bis-(trifluoromethyl)-4,4′-diaminobiphenyl (TFMB), is introduced to BPDA/ODA backbone to modify the comprehensive performance of this aerogel. Among all formulations, the resulted polyimide aerogels exhibit the lowest shrinkage and density as well as highest porosity, at the ODA/TFMB molar ratio of 5/5. Dielectric constants and loss tangents of the aerogels fall in the range of 1.29 to 1.33 and 0.001 to 0.004, respectively, and more TFMB fractions results in a slightly decrease of dielectric constant and loss tangent. In addition, moisture-resistance of the aerogels are dramatically enhanced as the water absorption decreasing from 415% for BPDA/ODA to 13% for the polyimide aerogel at the ODA/TFMB molar ratio of 7/3, and even to 4% for the homo-BPDA/TFMB polyimide aerogel, showing a superhydrophobic characteristic, which is a great advantage for polyimide aerogels used as low dielectric materials. Meanwhile, all of formulations of aerogels exhibit high absorption capacities for oils and common organic solvents, indicating that these fluorinated polyimide aerogels are good candidates for the separation of oils/organic solvents and water. Mechanical properties and thermal stability of the polyimide aerogels are also raised to varying degrees due to the rigid-rod biphenyl structure introduced by TFMB.

KEYWORDS: polyimide aerogel, trifluoromethyl group, low dielectric constant, moisture-resistant, absorption capacity