World Academy of Science, Engineering and Technology
International Journal of Materials and Textile Engineering
Vol:11, No:06, 2017

Effects of the Coagulation Bath and Reduction Process on SO2 Adsorption Capacity of Graphene Oxide Fiber

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Abstract : Sulfur dioxide (SO₂) is a very toxic air pollutant gas and it causes the greenhouse effect, photochemical smog, and acid rain, which threaten human health severely. Thus, the capture of SO₂ gas is very important for the environment. Graphene which is two-dimensional material has excellent mechanical, chemical, thermal properties, and many application areas such as energy storage devices, gas adsorption, sensing devices, and optical electronics. Further, graphene oxide (GO) is examined as a good adsorbent because of its important features such as functional groups (epoxy, carboxyl and hydroxyl) on the surface and layered structure. The SO₂ adsorption properties of the fibers are usually investigated on carbon fibers. In this study, potential adsorption capacity of GO fibers was researched. GO dispersion was first obtained with Hummers’ method from graphite, and then GO fibers were obtained via wet spinning process. These fibers were converted into a disc shape, dried, and then subjected to SO₂ gas adsorption test. The SO₂ gas adsorption capacity of GO fiber discs was investigated in the fields of utilization of different coagulation baths and reduction by hydrazine hydrate. As coagulation baths, single and triple baths were used. In single bath, only ethanol and CaCl₂ (calcium chloride) salt were added. In triple bath, each bath has a different concentration of water/ethanol and CaCl₂ salt, and the disc obtained from triple bath has been called as reference disk. The fibers which were produced with single bath were flexible and rough, and the analyses show that they had higher SO₂ adsorption capacity than triple bath fibers (reference disk). However, the reduction process did not increase the adsorption capacity, because the SEM images showed that the layers and uniform structure in the fiber form were damaged, and reduction decreased the functional groups which SO₂ will be attached. Scanning Electron Microscopy (SEM), Fourier Transform Infrared Spectroscopy (FTIR), X-Ray Diffraction (XRD) analyzes were performed on the fibers and discs, and the effects on the results were interpreted. In the future applications of the study, it is aimed that subjects such as pH and additives will be examined.

Keywords : coagulation bath, graphene oxide fiber, reduction, SO2 gas adsorption
Conference Title : ICTETT 2017 : International Conference on Textile Engineering and Textile Testing
Conference Location : Venice, Italy
Conference Dates : June 21-22, 2017

Open Science Index, Materials and Textile Engineering Vol:11, No:06, 2017 publications.waset.org/abstracts/68831.pdf