Poster

Fabrication and DMMP gas sensing characteristics of electron-beam treated PAN-based activated carbon fiber

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In this study, the effect of the oxygen functional groups on the activated carbon fibers (ACFs) surface on the sensing properties of dimethyl methylphosphonate (DMMP) gas as a nerve agent simulant was investigated. ACFs in a KOH solution were irradiated with an electron beam to modify their surface, and the surface changes were investigated. The untreated ACFs and electron-beam-treated ACFs were applied as DMMP gas-sensing electrodes, in which only a single fiber was used. The gas sensor fabricated from the untreated ACF showed a 2.3% resistance change upon exposure to DMMP gas, whereas the sensor made from the electron-beam-irradiated ACF showed an approximately 6.3% resistance change. This phenomenon is attributed to the increase in the number of oxygen functional groups caused by E-beam irradiation, as these functional groups can participate in hydrogen bonding with the DMMP gas. Therefore, direct charge transfer between the ACFs and DMMP molecules decreases the hole density in the ACFs and causes a decrease in their electrical resistance. This method provides a unique surface treatment method for improving the DMMP gas sensing efficiency.

Key words: Nerve agent; Gas sensing; Electron beam; Dimethyl methylphosphonate(DMMP)