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IR Detection by Semiconducting Carbon Fiber

Norio Muto, Masaru Miyayama, Hiroaki Yanagida,
Norihisa Mori,[1] Teijiro Kajiwara,[1] Yoshikazu Imai,[2]
Akira Urano[2] and Hiroshi Ichikawa[2]

RCAST, Univ. Tokyo, 4-6-1 Komaba, Meguro-ku, Tokyo 153
[1]Sogo Keibi-Hosho Co., Ltd., 1-6-6 Motoakasaka, Minato-ku, Tokyo 107
[2]Nippon Carbon Co. Ltd., Laboratory, 1-1 Shinurashima-cho, Kanagawa-ku, Yokohama-shi 221, Japan

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Three kinds of carbon fibers with different raw materials were used as semiconducting carbon fiber, and a polyacrylonitrile (PAN)-based carbon fiber was found to be a promising material for a thermal-type infrared (IR) sensor. The semiconducting carbon fiber showed negative temperature coefficient (NTC) resistance-temperature characteristics. The semiconducting carbon fiber with a higher resistivity showed a larger thermistor constant, and the output voltage of the IR sensor using semiconducting carbon fiber increased with increasing thermistor constant. The IR sensor detected the IR radiation with a steady output voltage for the IR source of the blackbody furnace at room temperature, and there was a short response time of 2.6 msec. The IR sensor using PAN-based carbon fiber with a thermistor constant above 2100 K could detect both mobile and immobile human bodies at room temperature when their body temperatures were higher or lower than room temperature.

1. Introduction

Simple and excellent infrared (IR) sensors which can detect mobile and immobile targets with a fast thermal response are needed in many fields. We found that three kinds of fibers (SiC, Si–Ti–C–O, and carbon fibers) with an adequate resistivity behave as n-type semiconductors, and show negative temperature coefficient (NTC) resistance-temperature characteristics.[1–3]