

Thermal-Type Blood Flow Sensor on Titanium Microneedle

Takashi Mineta, Yuki Tanahashi, Eiji Makino, Satoshi Toh¹,
Takahiro Kawashima² and Takayuki Shibata²

Graduate School of Science and Technology, Hirosaki University,
3 Bunkyo-cho, Hirosaki, Aomori 036-8561 Japan

¹Graduate School of Medicine, Hirosaki University,
5 Zaifu-cho, Hirosaki, Aomori 036-8562, Japan

²Department of Production Systems Engineering, Toyohashi University of Technology,
1-1 Hibarigaoka, Tempaku-cho, Toyohashi 441-8580, Japan

(Received August 1, 2008; accepted November 18, 2008)

Key words: thermal flow sensor, Ti needle, blood flow, electrochemical etching

In this paper, we describe a thermal-type blood flow microsensor that is inserted in a blood vessel and used to detect the flow rate change caused by a thrombus. The sensor is based on a Ti microneedle, on which a Pt microheater and a Pt-Au microthermocouple are formed. The microneedle was fabricated from a Ti sheet of 50 μm thickness by electrochemical etching and chemical etching in succession. The characteristics of the fabricated sensor were evaluated in flows of water and a viscous fluid in an artificial flow channel 1.2 mm in diameter. At a safe heating level ($\leq 42^\circ\text{C}$), the sensor could measure a flow velocity of up to several cm/s. The sensor has high sensitivity in the flow velocity range of 0–1 cm/s, indicating that it can detect the blood flow reduction due to a thrombus in a vein.

*Corresponding author: e-mail: mineta@cc.hirosaki-u.ac.jp