

Macromolecular Materials and Engineering

Volume 299, Issue 2, February 2014, Pages 198-207

**Micropatterning polypyrrole conducting polymer by pulsed electrical discharge** (Article)Anwar, M.M.<sup>a</sup>, Saleh, T.<sup>b</sup>, Madden, J.D.W.<sup>a</sup>, Takahata, K.<sup>a</sup><sup>a</sup> Department of Electrical and Computer Engineering, University of British Columbia, 2332 Main Mall, Vancouver BC, V6T 1Z4, Canada<sup>b</sup> Department of Mechatronics Engineering, International Islamic University Malaysia, P.O. Box 10, 50728 Kuala Lumpur, Malaysia

## Abstract

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Polypyrrole and other conducting polymers are of interest in actuators, sensors, energy storage devices and organic electronics. The patterning of these polymers can be challenging, particularly polypyrrole due to its insolubility. This paper reports the first micropatterning of polypyrrole using high-frequency pulses of extremely miniaturized electrical discharge. Microstructures with surface roughness of 70 nm are produced in the polymer with sub-micron depth control. Patterning of polypyrrole film deposited on a commercial medical catheter is demonstrated toward enabling smart catheters that use the patterned film as integrated actuators. This novel micropatterning capability opens up new possibilities for polypyrrole and likely other polymers, promoting micro-device applications for them. Polypyrrole, a promising conducting polymer, can be micropatterned through high-frequency pulses of extremely miniaturized electrical discharge generated on it. Fine micromachining with a controlled depth of 7.5 μm and an average surface roughness of 70 nm is demonstrated. The process is found to cause no major alteration in material composition. Fabrication of polypyrrole electrodes/actuators on medical catheters is also demonstrated. © 2014 WILEY-VCH Verlag GmbH & Co. KGaA, Weinheim.

## Reaxys Database Information

## Author keywords

actuators; conducting polymers; micropatterning, polypyrrole; pulsed discharge

ISSN: 14387492 CODEN: MMENF Source Type: Journal Original language: English

DOI: 10.1002/mame.201300048 Document Type: Article

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