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Conducting Polymers

Helical Synthetic Metals– Polypyrrole Deposited on Spirulina

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ABSTRACT

Microbes have interesting geometric structures. Plants and insects have the high order structure. We employed spirulina having spiral structure as a template for polymerization of pyrrole to obtain micro-conducting coils to construct "helical micro-coils" in micro-size.

Keywords: conducting polymer; micro coil; spiral structure

Introduction

Spirulina is a micro-alga and it has spiral structure, as seen in Figure 1. In this study, electrical conducting polymer was synthesized on spirulina to obtain micro-conducting coils.

Metal micro-coil has been prepared through application of helical form of spirulina [1]. Carbon micro-coil has been studied for wide range of applications [2]. Further, bio-carbon microcoils were invented. In this study, we attempt to prepare bio-conducting polymer microcoil composite. Up to date, there are no reports on applications of micro-organisms for electromagnetic devices. Conducting polymer, pyrrole was deposited on the surface of spirulina forming coil to make organic conducting coils.

Experiment

Polypyrrole/spirulina composite

$FeCl_3$ (0.02 g) were added to distilled water (2 mL), and spirulina solution (ca. 5 mL) were further added to the $FeCl_3$ solution. The solution was stirred by sonification for 35 minutes. After two days, spirulina was separated by a centrifugation. The spirulina containing $FeCl_3$ and sodium dodecyl sulfate (0.465 mg) as the surfactant were added to pyrrole (16.40 mg) in chloroform (0.45 mL) solution.

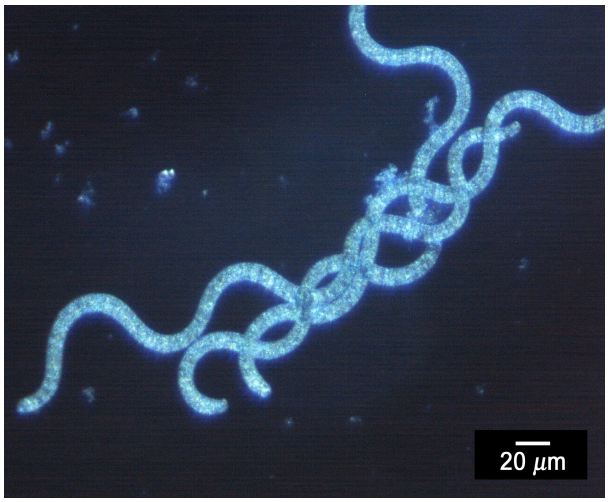

Figure 1. Optical microscopy image of spirulina.

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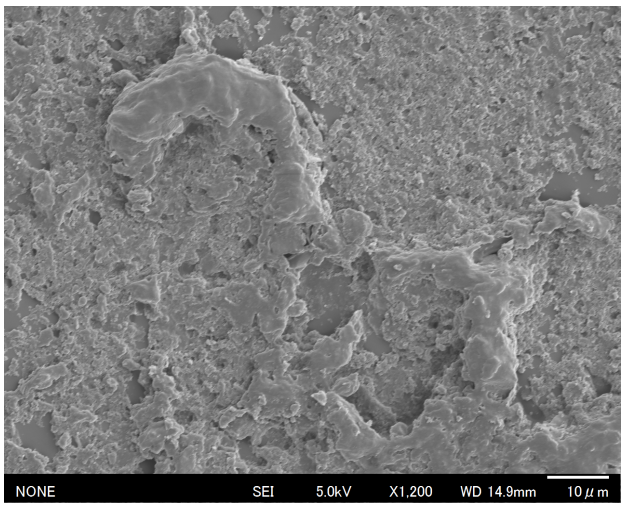

Figure2. SEM image of spirulina/polypyrrole.

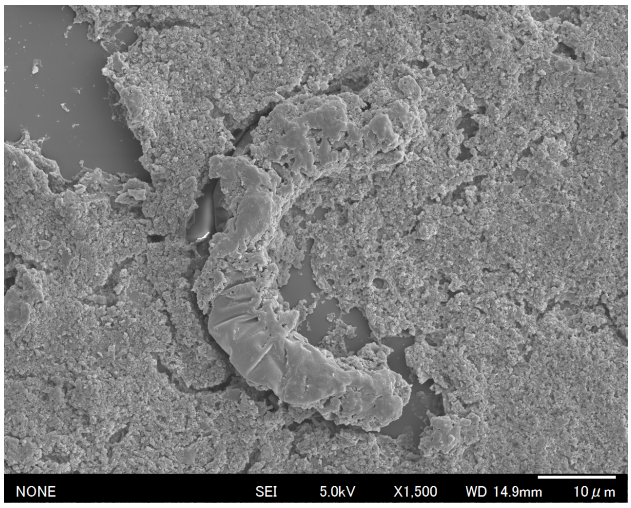

Figure 3. SEM image of surface of polypyrrole/spirulina conposite

Figs. 2,3 are scanning electron microscopy (SEM) images of spirulina/polypyrrole composite. Matrix materials of the sample is polypyrrole. Figure 4 shows Fourier transform infrared spectroscopy (FT-IR) measurement result of spirulina/polypyrrole composite. A signal at around 1500 cm^{-1} and 1400 cm^{-1} are due to the absorptions of pyrrole rings. An absorption band at 1200 cm^{-1} is attributed to C-N stretching vibration and at 1000-700 cm^{-1} C-H bond vibration.

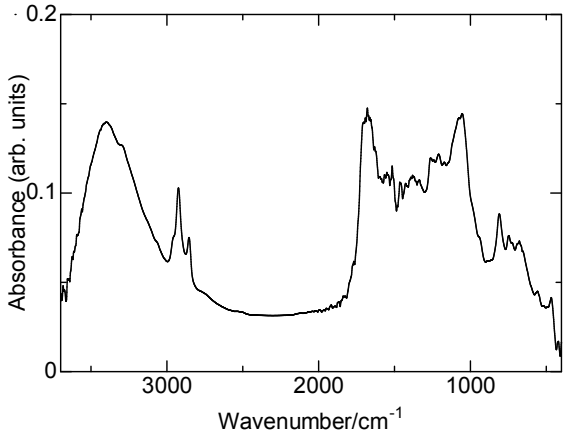

Figure 4. FT-IR spectrum of polypyrrole/spirurina composite.

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