Key Engineering Materials
ISSN: 1662-9795, Vol. 798, pp 304-309
doi:10.4028/www.scientific.net/KEM.798.304

Submitted: 2018-09-27
Revised: 2018-12-28
Accepted: 2019-01-08
Online: 2019-04-10

Effect of Poly(Vinyl Alcohol) on Thermoelectric Properties of Sodium Cobalt Oxide

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Keywords: thermoelectric material, sodium cobalt oxide, poly(vinyl alcohol) (PVA)

Abstract. Organic polymer composites are relatively simple to process and are therefore used in thermoelectric materials. The organic polymers are used as an adhesive agent between thermoelectric material grains. Thermoelectric effects of poly(vinyl alcohol) (PVA) composited with sodium cobalt oxide (Na_xCoO_2) were studied in this work. PVA is a low cost and an excellent biocompatibility polymer. High electrical conductivity, high Seebeck coefficient and low thermal conductivity are required in thermoelectric materials. As PVA is an insulating material, the PVA in between Na_xCoO_2 grain boundaries has an effect on the low electrical conductivity of Na_xCoO_2 composite. This results in a decrease in thermoelectric efficiency. However, PVA has been utilized to increase the Seebeck coefficient and also enhance thermoelectric efficiency. In order to improve the electrical conductivity of Na_xCoO_2 composite, released PVA was produced by furnace heating at 500° C to eliminate PVA from Na_xCoO_2/PVA sample. The general thermoelectric parameters including the Seebeck coefficient, electrical conductivity and power factor of Na_xCoO_2/PVA and composite and PVA removal sample were compared. X-ray diffraction patterns (XRD) and scanning electron microscope (SEM) images were used to identify the phase identification and morphology study, respectively. The results showed that the PVA removal sample had higher electrical conductivity than the Na_xCoO_2/PVA sample. However, Na_xCoO_2/PVA sample had higher thermoelectric performance than the PVA removal sample because the Na_xCoO_2/PVA sample showed higher Seebeck coefficient and power factor.