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Optimization of Parameters for Electrospinning of Pan Nanofibers by Taguchi Method

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Abstract : The effects of polymer concentration and electrospinning process parameters on the average diameters of electrospun polyacrylonitrile (PAN) nanofibers were experimentally investigated. Besides, mechanical and thermal properties of PAN nanofibers were examined by tensile test and thermogravimetric analysis (TGA), respectively. For this purpose, the polymer concentration, solution feed rate, supply voltage and tip-to-collector distance were determined as the control factors. To succeed these aims, Taguchi's L16 orthogonal design (4 parameters, 4 level) was employed for the experimental design. Optimal electrospinning conditions were defined using the signal-to-noise (S/N) ratio that was calculated from diameters of the electrospun PAN nanofibers according to "the-smaller-the-better" approachment. In addition, analysis of variance (ANOVA) was evaluated to conclude the statistical significance of the process parameters. The smallest diameter of PAN nanofibers was observed. According to the S/N ratio response results, the most effective parameter on finding out of nanofiber diameter was determined. Finally, the Taguchi design of experiments method has been found to be an effective method to statistically optimize the critical electrospinning parameters used in nanofiber production. After determining the optimum process parameters of nanofiber production, electrical conductivity and fuel cell performance of electrospun PAN nanofibers on the carbon papers will be evaluated.

Keywords : nanofiber, electrospinning, polyacrylonitrile, Taguchi method
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