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Digital Image Processing of SEM image of Polymer Nanocomposite Thin Film Using Java Based Program Image J.

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Abstract:

Various images obtain from TEM; SEM can be analyzed with the help of computer image analysis software. Image processing is used to describe the size, shape, surface topography of micro or nano structure materials. In the present paper the characterization analysis is being reported qualitatively by using digital image processing of SEM/TEM image of some nanomaterials. This novel technique is an effective experimental tool for the detailed structural characterization. For image processing Java based software ImageJ is used in the present study.

Key words: nano-crystals; grain size ; image analysis;

Introduction:

Nanomaterial science researchers follow two main steps before the fabrication of various devices/ nanodevices i.e. material preparation and its structural characterization [1]. After the preparation of material, its characterization study is very important, on the basis of which the materials is categorized for any specific device. This is also helpful to understand the mechanism of change in its specific property of the given regime. Modelling of the physical properties is possible only after the detailed characterization and study of various properties as a function of relevant parameters. For structural characterization frequently used techniques are XRD analysis and SEM/TEM study. For phase analysis DSC/DTA is used [2].

In most of the structural characterization techniques only the qualitative analysis is given importance. For further and detailed quantitative analysis other relevant analytical softwares or tools are used. In the present paper we are introducing a novel tool based on digital image processing for the structural characterization analysis. This tool is used first time for the study of quantitative characterization of such type of polymeric system.

Digital image processing

Thus every input of an IP is an image or a sequence of images which produce an output as a modified image or a set of parameters and function which describe the content of input image. Software for IP consists of specialized modules that performs specific task which enable us to generate quantitative information for the individual and group of particles/ nano-particles. For

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individual particle, size information (length, width and height) and other physical properties (such as morphology and surface texture) can be measured. Statistics of group of particles can also be measured through image analysis and data processing. Commonly desired ensemble statistics includes, particle count, particle size distribution, surface area distribution and volume distribution. With the knowledge of material density, mass distribution can be calculated [3-5].

Results and discussion:

For digital image processing Java based software ImageJ is used in the present study [6]. First step of image processing is defining region of interest (ROI). The most convenient ROI shape is square or rectangular. image processing of SEM image of NCPE (OCC) 93[70PEO: 30AgCl]: 7TiO_2 by image J is shown below. Figure 2 (a&b) shows enhanced SEM image along with its stretched histogram respectively. Histogram is estimated by counting number of times each brightness or grey level occurs in the image.

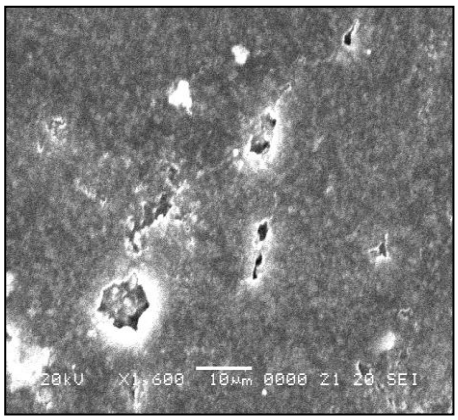

Figure1: SEM image of 93[70PEO:30AgCl]:7TiO_2

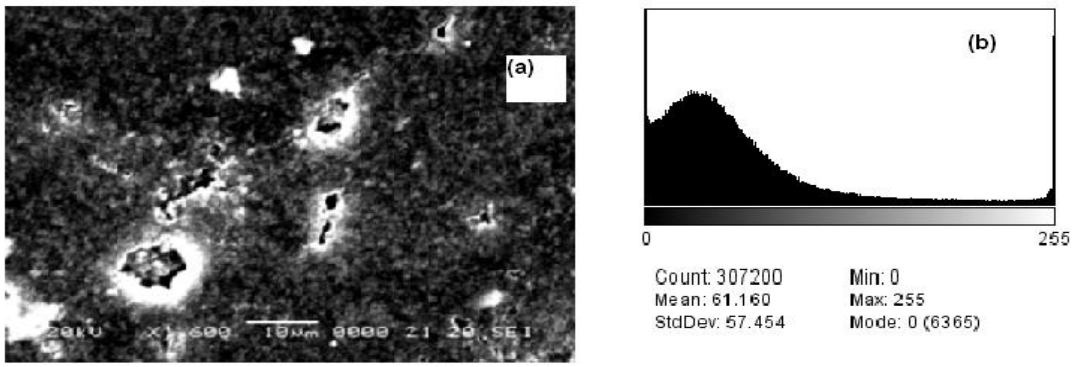

Figure 2: Enhanced SEM image of NCPE membrane of composition 93[70PEO: 30AgCl]: 7TiO_2 (b) stretched histogram of enhanced image.

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Conclusion:

Qualitative analysis of the SEM image of Nanocomposite Polymer electrolyte membrane of composition 93[70PEO: 30AgCl]: 7TiO_2 is done by digital image processing using Java based software Image J. Image processing of SEM image confirms enhancement of amorphousity of the membrane by the addition of nanosize filler particles. Also porosity of the membrane increases in Nanocomposite Polymer electrolyte.

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