

EXPONENTIAL CONTRAST STRETCHING TECHNIQUES FOR SEM CHARGING EFFECTS

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Charging is a commonly known problem when inspecting an insulating sample under a scanning electron microscope (SEM). It will cause image distortion, create an unpleasant view, and may lead to wrong interpretation of the results. In this paper, we propose to characterize the charging image using statistical central moments as well as to reduce the charging effect on SEM images. After identifying the charging image through the characteristics, a post processing technique is applied to reduce the charging effects. The idea is not to modify the sample nor to modify the SEM environment, but to introduce a post-processing method so that the charging image can be improved. It is noticed that the post-processing method is only used to enhance the normal condition of the secondary electron (SE) and backscattered-electron (BSE) images in SEM (Lee and Kelly, 1980), but never been applied on charging SEM images. It is also noticed that analysis of image histogram is a powerful engineering tool to portray information of an image. It can be used to provide solutions to improve quality control, but again has never been used on improving the quality of a charging image. Some of the improved techniques of histogram equalization with brightness preserving include the bi-histogram equalization (BHE) (Kim 1997) and recursive mean-separate histogram equalization (RMSHE) (Chen and Ramli 2003). In this paper, the effects of these methods on charging image are examined with a new compensation technique. The study has shown that the second moment variance and third moment skewness can be used to differentiate between charging and non-charging images. In general, the charging image will show higher variance values and negative skewness values. After characterizing the charging images, the exponential contrast stretching technique is applied. With the ECS compensation technique, the charging effect can be minimized and the results are better than those from using the HE, BSE, or RSIHE methods.

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