A Novel Method for Ion Track Counting in Polycarbonate Detector

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Abstract

A computer program for recognizing and counting the track of ions that detected with polycarbonate detector has been written using Matlab software. There are Different programs for counting the track of ions in different detectors. Algorithm of this program specially has been written for polycarbonate detector and also low magnification of optical microscope. Thus with this method in per image of optical microscope greater numbers of ions are visible and general distribution of ions can be better known. However, accuracy of counting program is very high.

Keywords: comparison algorithm, image processing, microscope, ion track, counter.

1. Introduction

Polycarbonate is one of the detectors that used in solid state electro chemical etching detection method. When ions strike with polycarbonate detector, tracks are generated in detector. After several hours of etching in special solution and apply high voltage to polycarbonate, ion tracks can be seen with unaided eyes. This detection method is being done more than three decades by Sohrabi [1-5]. After etching detector and apply high voltage to etching chamber, ion tracks must
be counted and local determined. A picture is taken from tracks, using optical microscope and
CCD camera that connected to computer. This picture is read by proposed algorithm, and then
number of ion tracks is counted and local determined with high accuracy. Different
magnification is used for seeing the tracks. Our optical microscope has three magnifications
degree: ten times, forty times and hundred times. The goal is counting the total of ions, therefore
if the image magnification is low, then more ion tracks can be seen in the picture and distribution
will be shown better. For this reason, program algorithm is written for picture with low
magnification and also it has high accuracy.

2. Algorithm of new method

A variety of methods for counting ion tracks in different detectors have been proposed so far
[6-9]. Presented program in this study is written specially for the polycarbonate detector and also
low magnification. Comparison is done between pixels and this procedure continues in whole of
picture. Using this algorithm, all of the tracks are determined and the coordinates of them are
specified. Pictures of ion tracks in polycarbonate detector with high magnification are shown in
Figure 1. A picture with low magnification is shown in Figure 2.
Figure 1. Pictures of tracks with high magnification.

Figure 2. Picture of tracks with low magnification.
Algorithm of the program is as follows:

**Reading the image**

**Convert image to gray scale:**

In order to improve the accuracy of counting, image is converted to black and white image.

**Inverting the image**

**Convert image to binary:**

After inverting the image, it should convert to binary. At first threshold level should be determined such that the tracks are perfectly specified. This threshold level has a significant effect on the final counting process.

**Comparison of pixels:**

This part is the main and most important part of the program. Program is beginning from second column and second row and comparing the current pixel with surrounding pixels. After comparison, this method is repeated for next pixel. This comparison is done for whole pixels of the picture and finally, number of tracks and local coordinates are determined. The flowchart of program is shown in Figure 3.
According to algorithm, the comparing method is pixel by pixel in image. With this method high accuracy in counting has been acquired.

Figure 3. Flowchart of program.
3. Algorithm Simulation

The procedure of proposed algorithm is explained for a sample image in the following. The tracks are specified in Figure 4 with red circles. All the tracks are found in this sample image. Each pixel in the image is like sample pixel in Figure 5.

![Figure 4](image1)

(a) Determination of tracks in the image.

(b) Determination of tracks in the image.

Figure 4. Determination of tracks in the image.

![Figure 5](image2)

Figure 5. A sample pixel of a track.
4. Conclusion

As it is seen from images, the new algorithm, which is based to read low magnification images, has high accuracy. The algorithm has many advantages. For example more regions and tracks could be investigated and counted.

References