



جامعة الموصل  
كلية التربية للعلوم الصرفة

## معادلة جديدة لحساب معدل قشط الأثر النووي لجسيمات ألفا في كاشف CR-39

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## Abstract

Recently, researchers devoted their efforts to measure physical track parameters, through direct measurement of the track length. This achieved by means of detecting the growth and development of the track. The growth and development observed using the microscopic images of the tracks etched within specific time intervals. In the current study, the nuclear track detector CR-39 was irradiated using the Americium  $^{241}\text{Am}$  of alpha energies (3.17, 3.59 and 4.13) MeV for sequenced etching periods (15-30) minutes. The chemical solution of hydroxide of sodium NaOH (6.25 N  $70 \pm 1$  °C) were used to etch the sample under study. Then, the images were obtained using a microscope provided with a digital camera and connected to a PC.

There is a lack in the number of equations that describe the track parameters. Therefore, the researcher focused on establishing a new experimental equation capable of finding the track etch rate as a function of the etching time. Although obtaining such equation is a hard task, however an equation was formalized in which the track etch rate as a function of time  $V_T(t)$  is considered. The established equation includes four free parameters. At the primary examination of obtained equation, the parameters were left free during the fitting process. These parameters were studied at different alpha particle energies. This obtained by relating these parameters with alpha energy in the equations. Having that done, a noticeable improvement in the fitting process and the results were observed. This can be attributed to the fact that the change of these parameters with alpha particle energy is

exponential . On the other hand, a series of comparisons were done between the experimental results obtained in this study and that obtained using Track-Test package using the first three equations of (TT-1) [Green *et. al.*, 1982] (TT-1), the second equation of (TT-2) [Burn *et. al.* 1999] , the third of [Yu *et al.*, 2005] (TT-3) and the four equation of (TT-4) [Al-Jubbori, 2020]. For the sake of comparison, the standard constants given in the program were considered. Through these comparisons, it was shown that the figures resulted from the Track-Test program of A-Jubbori's equation were compatible with the experimental images of track profile and the roundness of its walls and there are agreement of the track length and saturation etching time, the results of the first second equation of Green *et al.*, (TT-1), Burn *et. al.* (TT-2) and Yu *et al.* (TT-3), there was inconsistency with the experimental results. Moreover, the results also elucidated that the maximum track length and saturation time of the experimental results is different from Track-Test program result.

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**A new equation to evaluation the nuclear track etch  
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