

## **Dedication**

To the soul of my father and grandfather

To My grandmother

My mother

A very special My wife Wishah

My Children Mohammed, Mayar and

Lamar

My family and friends

## **Acknowledgements**

First of all I render my thanks and prayers to God who offered me the health and strength to this work.

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## **Abstract**

Using Radiation Technology by laser pulsation it does not need to bring samples but it could be irradiating by pulses laser CO<sub>2</sub> into small spaces being taken into account so as not to make damages on sample during irradiating.

Laser devices provide a large quantity of power precisely in exact area of material in order to make required response, particularly in dim materials.

The power has been absorbed near the surface which leads to change the chemistry of surface, crystal structure or form change with different degrees without change in properties of material.

The aim of thesis, to concerning or treating photovoltaic solar cell by laser pulsation that makes grooves on surface of cell with various distances and depths that lead to increase cell absorption to photovoltaic solar cell has been incidence on it.

In this study many of photovoltaic solar cells been radiated in two dimensions in different ranges 3 cm x 3 cm, 2 cm x 2 cm, 1 cm x 1 cm by carbon dioxide laser.

Photovoltaic solar cell has been tested before and after radiation process taken in account fill factor and efficiency of photovoltaic solar cell and the comparison between them.

That is remarkable, increasing in fill factor and efficiency of photovoltaic after radiation, so we found fill factor before irradiation 0.683, and after irradiation process for the three dimensions respectively 0.742, 0.752 and 0.768

The efficiency of photovoltaic before irradiation 11 and after irradiation 12.25, 12.94 and 13.28 respectively.

Photovoltaic solar cell has been studied before & after irradiation process by scanning electron microscope. This showed the presence of grooves on the surface of the photovoltaic solar cell after radiated by laser pulses.

The use of surface irradiation laser technology ( $\text{CO}_2$ ) increase the absorption of the solar radiation in the Silicon photovoltaic cause nano/micro structure in the silicon surface, which is turn increase the efficiency of the silicon photovoltaic cell.

## المستخلص

إن استخدام تقنية التشعيع بنبضات ليزريه لا يحتاج لتحضير العينات بصورة معينة وإنما تشعييعها بنبضات ليزر ثاني أكسيد الكربون إلى مساحات صغيرة فقط آخذين في الحسبان عدم إحداث أي أضرار على العينة السليكونية عند تشعييعها.

تعمل أجهزة الليزر على إسقاط كميات كبيرة من الطاقة بدقة في مناطق محصورة من المادة من أجل تحقيق الإستجابة المطلوبة , بالنسبة للمواد المعتمة يتم امتصاص هذه الطاقة بالقرب من السطح مما يؤدي إلى تغيير في كيمياء السطح , التركيب البلوري, أو التشكل متعدد الدرجات دون تغيير في خواص المادة, هذه الدراسة تعبير للمبادئ الأساسية التي تحكم انتشار الليزر والامتصاص بالإضافة لاستجابة المادة المترتبة .

الهدف من هذه الأطروحة هو معاملة سطح الخلية السليكونية بنبضات ليزرية (تسليط ضوء) لإحداث أخاديد على سطح الخلية وبمسافات وأعماق متفاوتة مما يؤدي إلى زيادة امتصاص الخلية للشعاع الشمسي الساقط عليها.

في هذه الدراسة تم تشعيع عينات من الخلايا الشمسية السليكونية في بعدين بمساحات مختلفة  $1\text{cm}\times 1\text{cm}$ ,  $2\text{cm}\times 2\text{cm}$ ,  $3\text{cm}\times 3\text{cm}$  بواسطة ليزر ثاني أكسيد الكربون .

تم اختبار أداء الخلية الضوئية السليكونية قبل وبعد عملية التشعيع وذلك بحساب معامل الامتلاء وكفاءة الخلية والمقارنة بينهما.

لوحظ الزيادة في معامل الامتلاء وكفاءة الخلية الضوئية السليكونية بعد التشعيع, حيث وجد معامل الامتلاء قبل التشعيع 0.683, وبعد عملية التشعيع للمساحات الثلاث 0.768 , 0.752 , 0.742, على التوالي .

كفاءة الخلية الضوئية السليكونية قبل التشعيع 11 وبعد التشعيع للمساحات الثلاث 12.28, 12.97 , 13.24 على التوالي.

تم دراسة كيمياء السطح قبل وبعد التشعيع بواسطة المجهر الماسح الالكتروني (SEM) الذي اظهر وجود أخاديد على سطح الخلية الضوئية السليكونية بعد تشعييعها بالليزر النبضي ثاني أكسيد الكربون.

استخدام تقنية التشعيع السطحي بالليزر النبضي ثاني أكسيد الكربون يزيد من امتصاص الأشعة الشمسية الساقطة مما يحدث تركيب نانوي/ مايكروني في سطح الخلية الضوئية السليكونية والذي يزيد بدوره كفاءة الخلية الضوئية السليكونية.

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