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# Some of Mechanical Properties to Nanosilica and Nanographene used in Medical Application

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***Abstract:***

In this study lower surface hardness was measured and found increases with increasing exposure time, also lower surface hardness depend on intensity and graphene and silica with methacrylate the basic component of the filling into a uniform distribution of stress, It is able to reduce the incidence of stress concentration, result in a major growth of the characteristic mechanical of the resultant compounds. Degree of cure depends on the time period of exposure, filling type, volume fractional of the filler and light intensity. Raman spectrum to nanosilica and nanographene proved this materials are crystalline.

***Keywords:*** *nanographene, nanosilica, lower surface hardness.*

## INTRODUCTION

The engineering of materials in nanometer scale, developed to an initial modern fields centered on physical, chemical and materials science [1] $SiO_2$ nanospheres have high surface, reactivity and are considered as a supporting material[2] Graphene a two dimensional carbon allotrope , has been look like as an interesting material of the 21st century, and received a worldwide consideration due to its amazing mechanical properties. Graphene and all its derivatives are being planned in different fields of science from medicine [3]. graphene is the forename indicate to a flat monolayer of carbon atoms tightly constrained into two-dimensional 2-D honeycomb lattice, which is a basic construction of all added graphitic materials[4] Composite resin was used as a dental filling because it displayed good mechanical properties like low thermal expansion and high wear resistance, but these materials suffered in the beginning of its manufacture from problems, for instance, polymerization shrinkage, little color stability, and weak adhesion in teeth. Afterward, several improvements happened to this resin composite to solve these problems[5] The aim of study: studying some mechanical characters of silica nanoparticles and nanographene added to composite resin to promote their use in the manufacture of dental fillings .

## Experimental Materials Used

### Preparation of nanographene

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## Raman spectroscopy

Raman spectroscopy consider as spectroscopic procedure depended on inelastic sprinkling of monochromatic light , typically come from a laser source. Inelastic scattering earnings that the incidence of photons in monochromatic light alterations upon interaction, with a model [8]. A JobinYvon spectrometer HR800 for the Raman dimensions, prepared with 442 nm Ar excitation laser and a absorbed spot size of about 0.8 µm by a100×objective (NA=0.9). The sideways resolution of the Raman dimensions also based on the laser scanning stage, that was ranging from 0.1 and 0.5 µm in this time study. The permeation depth (d) of the laser radiation is nearly 200 nm into Silica and graphene in this case [9].

## Results and Discussions

### Lower surface hardness

The results from figures (1) and (2) and tables (1) and (2) show that lower surface hardness values were little because nanomaterial absorbs light and prevents passing within matter and reaches the lower surface. When the percentage of filing increasing the Lower surface hardness decrease and when nanosilica added at ratio (0.1mg) hardness increase also nanographene added at ratio (0.1mg) hardness increase because when it gets loaded nanomaterial will absorb most of the radiation and does not allow for radiation reaches the lower surface this is agree with [10, 11,12,13]. The result in this study reveled the lower surface hardness increases with elevating exposure time, also lower surface hardness depend on intensity of illumination and distance(From filing to source party), and composite type interaction forces between organic and inorganic phase and homogeneous dispersion for graphene and silica with methacrylate the basic component

Graphene Platelet Nano-powder form: Black powder

Morphology: platelet thickness: (6-8 nm) Average Particle Diameter: 15 micron Surface Area:120-150 m2/g Content of Carbon: 99.5+% Electrical Conductivity siemens/meter:

107(parallel to surface), 102(perpendicular to surface)Thermal Conductivity (watts /meter –K ) :

3000 ( parallel to surface) ,6 ( perpendicular to surface )

Thermal expansion (M/M/deg.-K):

4-6x10-6(parallel to surface),0.5-1.0x10-6(perpendicular to surface)

### preparation of nanosilica($SiO_2$):

Nanoparticles US Research Nanomaterials diameter (10nm) and thickness (3-6nm)

### Hardness

The hardness feature considers as the most important features for comparing among materials using in tooth treatment. Hardness definitude as the resistance of material surface to indention and measured by $N/mm^2$. By this definition, it became clear the importance of this feature in dentistry. The scratch results in stress cases and failure to material[6]. Hardness is influenced by many features: type of the composite resin, kind of the filler, fractional size of the filler, and polymerization degree [7].

### Degree of Cure (DGOC)

Degree of cure is the proportion between the hardness of inner (lower) exterior -surface to the hardness of periphrasis (upper) surface multiplied by 100% as in the equation :

Degree of cure= (inner surface hardness/exposure surface hardness ) x 100% ----------------------------- (1)

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with strong adhesion between graphene and silica with methacrylate and barium glass it's the filling material To enhance the mechanical characteristics of combination materials by graphene and silica[14]

of the filling into a uniform distribution of stress, It's able to reduce the occurrence of stress concentration, result to a noteworthy rise in the mechanical characteristics of the, resultant compounds. Regular light scattering works, along

**Table (1) influence add nanosilica to composite resin on hardness property units(MPa) for the lower surface of the filling periods( 20, 25, 30) seconds**

| Laser Time | hardness at 0.02% gm ratio | hardness at 0.05% gm ratio | hardness at 0.1% gm ratio | hardness at 0.2% gm ratio | hardness at 1% gm ratio |
|---|---|---|---|---|---|
| 20 sec | 55.9 | 49.2 | 43 | 40.7 | 35 |
| 25 sec | 62.4 | 58.7 | 47.1 | 43.3 | 41.5 |
| 30 sec | 87.1 | 78.2 | 65.4 | 63.1 | 55.9 |

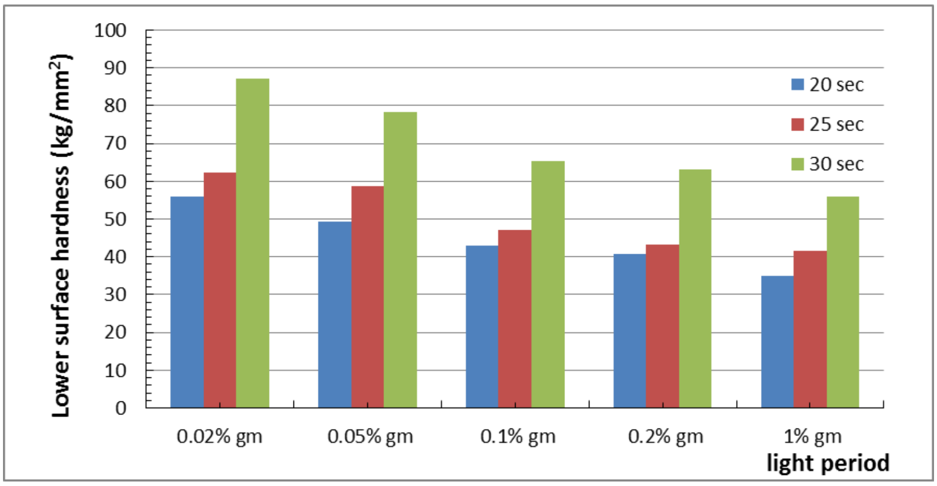


**Figure (1) influence add nanosilica to composite resin on hardness property units(MPa) for the lower surface of the filling periods( 20, 25, 30) seconds**

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**Table (2) influence add nanographene to composite resin on hardness property units(MPa) for the lower surface of the filling periods( 20,**

**25, 30) seconds.**

| Laser Time | hardness at 0.02% gm ratio | hardness at 0.05% gm ratio | hardness at 0.07% gm ratio | hardness at 0.09% gm ratio | hardness at 0.1% gm ratio |
|---|---|---|---|---|---|
| 20 sec | 53.9 | 44.2 | 40 | 38.3 | 35 |
| 25 sec | 58.4 | 56.3 | 41.1 | 39.9 | 41.5 |
| 30 sec | 77.1 | 74.5 | 60.4 | 55 | 55.9 |

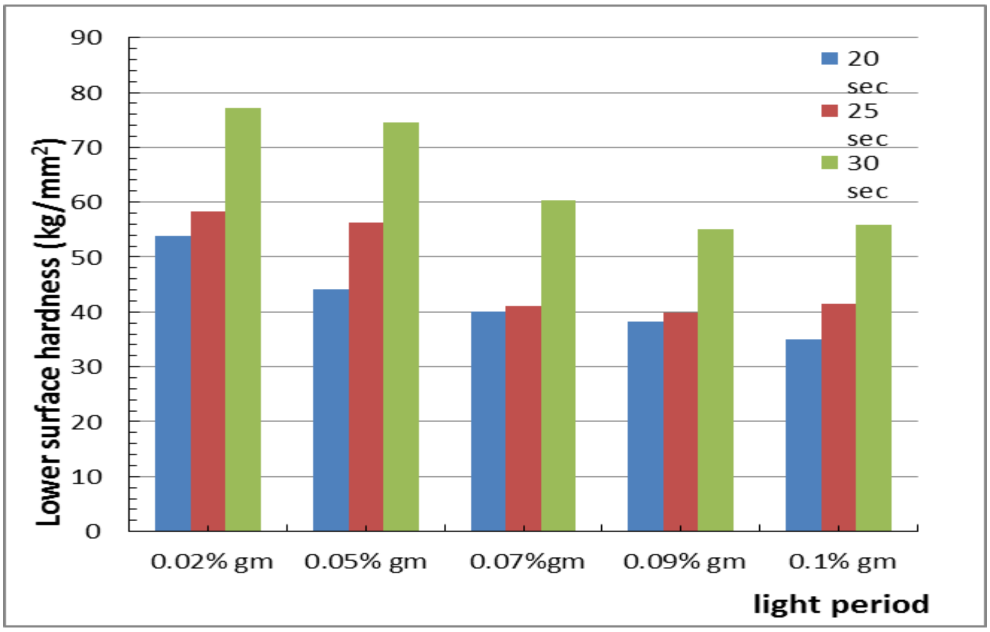


**Figure (2) influence add nanographene to composite resin on hardness property units (MPa) for the lower surface of the filling periods( 20, 25, 30) seconds**

**Degree of Cure (DGOC)**

The degree of cure revealed amount of penetrating light of the material and gives the amount of light that reaches the lower surface. Degree of cure depends on the period of exposure, filling type, volume fractional of the filler, and light intensity[15]

**Table (3) influence add nanosilica to composite resin on DGOC periods (20, 25, 30) seconds**

| light | DGOC at | DGOC at 0.05% | DGOC at 0.1% | DGOC at 0.2% | DGOC at |
|---|---|---|---|---|---|

| period | 0.02% gm | gm ratio | gm ratio | gm ratio | 1 % gm ratio |
|---|---|---|---|---|---|
| 20 sec | 0.599 | 0.571 | 0.467 | 0.467 | 0.374 |
| 25 sec | 0.650 | 0.667 | 0.511 | 0.487 | 0.438 |
| 30 sec | 0.903 | 0.828 | 0.700 | 0.661 | 0.577 |

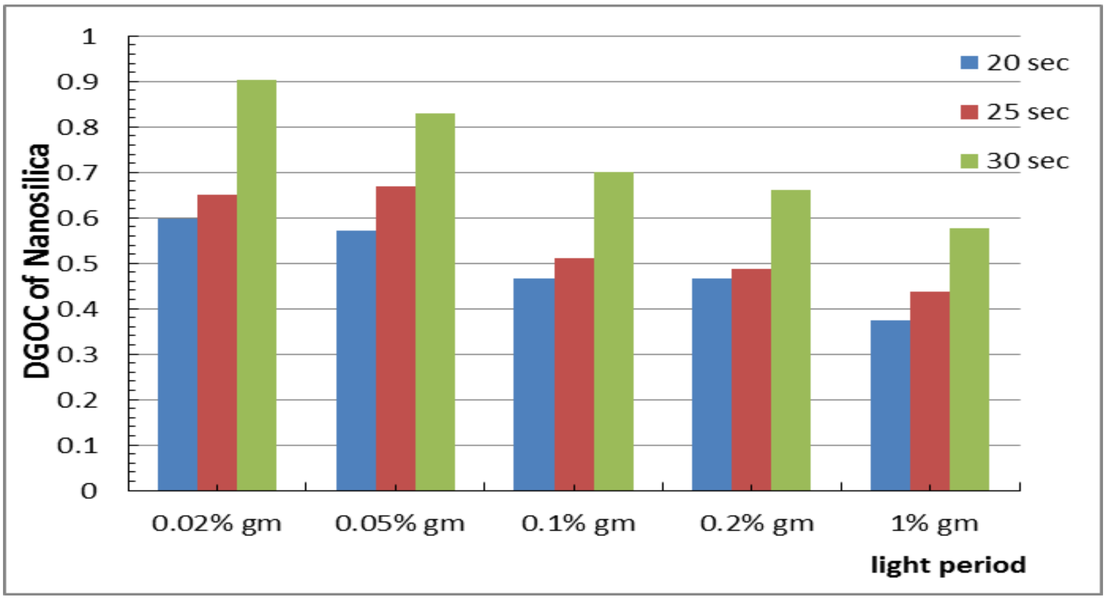


**Figure (3) influence add nanosilica to composite resin on DGOC periods( 20, 25, 30) seconds**

**Table (4) influence add nanographene to composite resin on DGOC periods( 20, 25, 30) seconds**

| light period | DGOC at 0.02% gm | DGOC at 0.05% gm ratio | DGOC at 0.07% gm ratio | DGOC at 0.09% gm ratio | DGOC at 0.1 % gm ratio |
|---|---|---|---|---|---|
| 20 sec | 0.613 | 0.514 | 0.464 | 0.435 | 0.374 |
| 25 sec | 0.651 | 0.634 | 0.452 | 0.448 | 0.437 |
| 30 sec | 0.833 | 0.827 | 0.647 | 0.611 | 0.587 |

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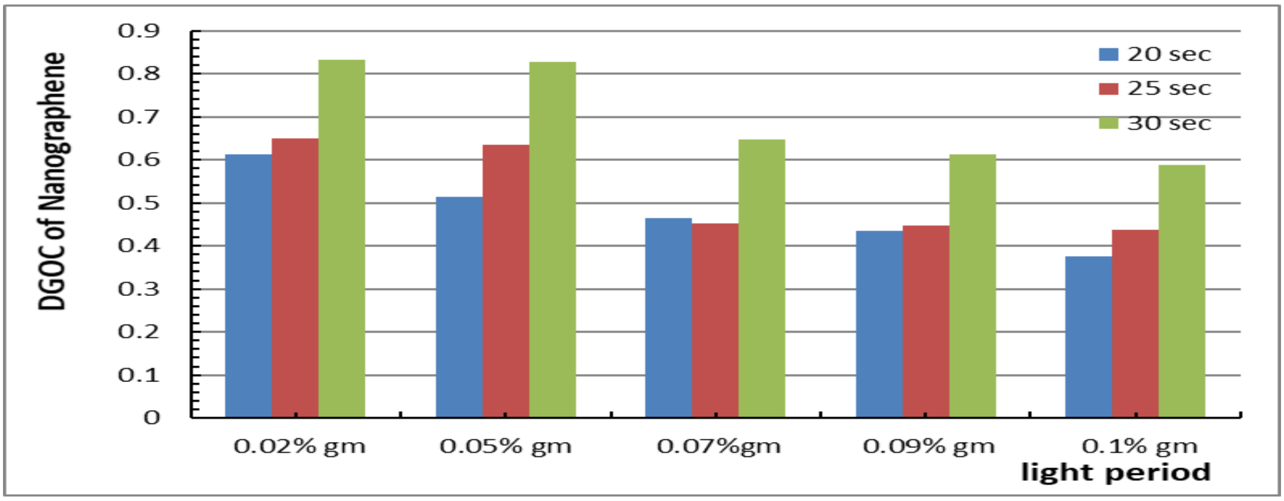


**Figure (4) influence add nanographene to composite resin on DGOC periods( 20, 25, 30) seconds**

1800 cm Raman modes are basically Si-Si systems. Therefore, could be customize a package Raman in the region 1500-1800 for SiO. Si-Si pattern component. Thus, the shift in Raman samples mainly relaxed style Si-Si. [19,20] The Raman sign is completely altered from those notes in the nanostructures or groups larger than( 2-3 nm), which can be explained by its size of about (1nm) clusters [20]. Raman spectrum of a usual nanographene has B band top at 1600cm$^{-1}$ indicating the formation of agraphitized structure, and a A band peak at 1380 cm$^{-1}$ analogous to the disorder-induced phonon mode. Moreover, the B band peak is accompanied by a shoulder peak at1600 cm$^{-1}$A band[21]. This broad top is related with fixed-size graphite crystals and also graphene edges. The high two peaks in the spectra in this study propose an additional nanocrystallines construction and this graphene edge and faults, that are predominant constructions of nanographene. The peak around1600 cm$^{-1}$ created by the weak B band enclosed by the A band [22,23]. The nanographene and nanosilica with rising composite can be used with fillers because this compound has great mechanical characteristic as evidenced by the results degree of cure (DGOC) and lower surface hardness.

From fig.( 3) and (4) and table (3) and (4) can be conclude that degree of cure increases with elevating time of light exposure because the hardness of lower surface was increasing with exposure time this is produce to the penetration of light increased in the fillers [16]. in the tables and figures above, showed that lower surface hardness in the groups studied the larger amount of light is absorbed near the surface and doesn’t reach the lower surface[17]

### Raman Spectroscopy Analysis

Raman spectrum observed broad peak to nanosilica and vibration spectrum partial strings when number wave(1650$cm^{-1}$) to reach high intensity which is characterized by nanosilica because it is a mixture of two materials this result agree with Williams and Adams . That because the width (peak) in Raman spectrum results from the Union of silicon and oxygen and Silicon spectrum be bold because oxygen blending with Silicon broad spectrum seen [18] The Raman sign is not sensitive to oxygen-Silicon links to SiO samples and a-Si show similar spectra. Perhaps the character of the band Si-O in turning Raman very weak to describe the Raman shift measured in the samples of this study. In the area of 1500 to

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**Figure (5) measurement of nanosilica by Raman spectrum**

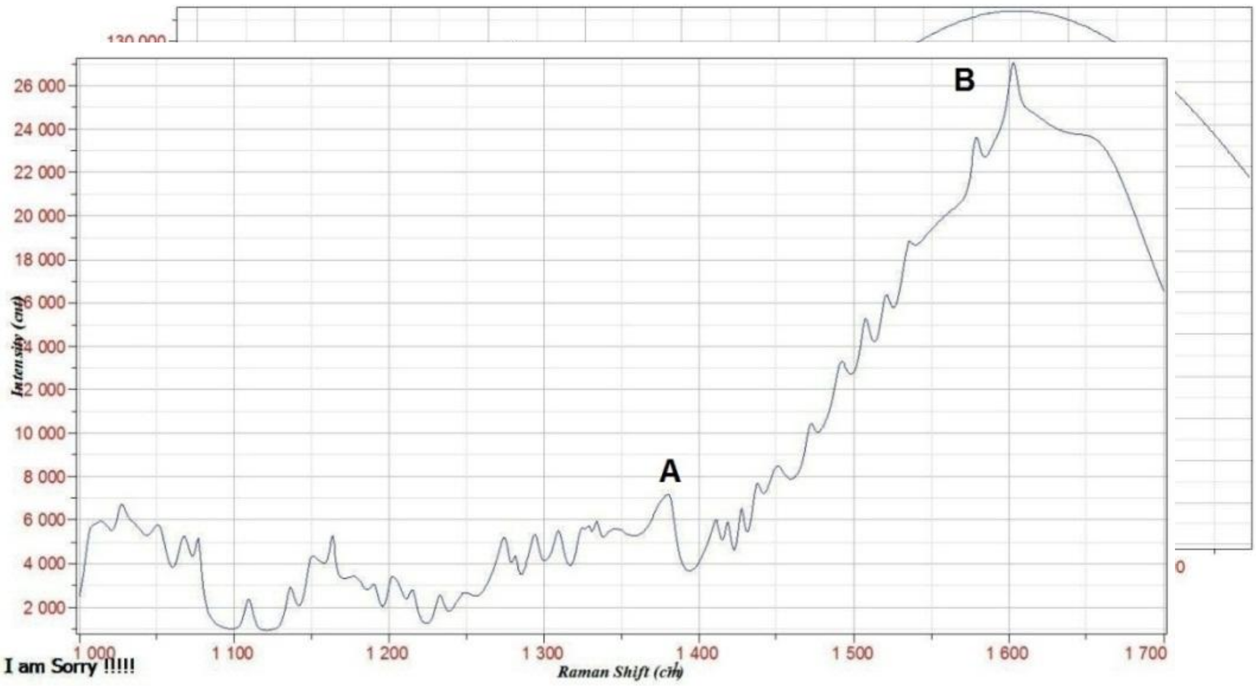


**Figure (6) measurement of nangraphene by Raman spectrum**

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**Conclusion**:The nanosilica and nanographene have lower surface hardness increases with increasing exposure time this mean lower surface hardness is lowest but when composite configuration from nanosilica and nanographene with methacrylate the basic component of the filling into a uniform distribution of stress. Regular light scattering works, along with strong adhesion between graphene and silica with methacrylate and barium glass it's the filling material to enhance the characteristicproperties of composite materials through graphene and silica.

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