



UNIVERSIDAD
DE LOS ANDES
MERIDA VENEZUELA

Resinas Compuestas

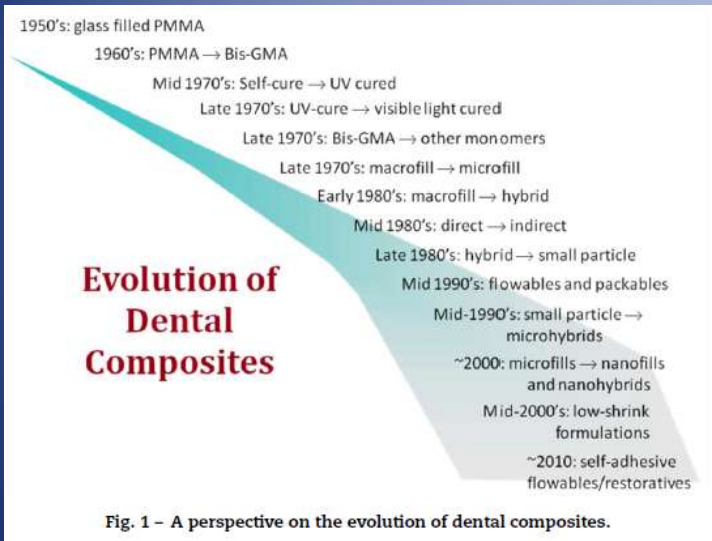
**Od. Robert A. Ramírez M.
Universidad de Los Andes.
Odontología Restauradora.
Cátedra de Operatoria Dental.**

¿Por qué han evolucionado las resinas compuestas?

Alta versatilidad

- Materiales restauradores.
- Forros cavitarios.
- Selladores de puntos y fisuras.
- Reconstrucción de muñones.
- Inlays, Onlays y Coronas.
- Restauraciones provisionales.
- Cementación de prótesis simples ó múltiples.
- Fijación de dispositivos de ortodoncia.
- Selladores endodónticos.
- Cementación de postes.

Evolución de los últimos 50 años



Matriz polimérica.

Enfocadas en reducir la contracción por polimerización, y “tal vez” el estrés por la contracción de polimerización.

Auto-Adhesión

Auto-Reparación

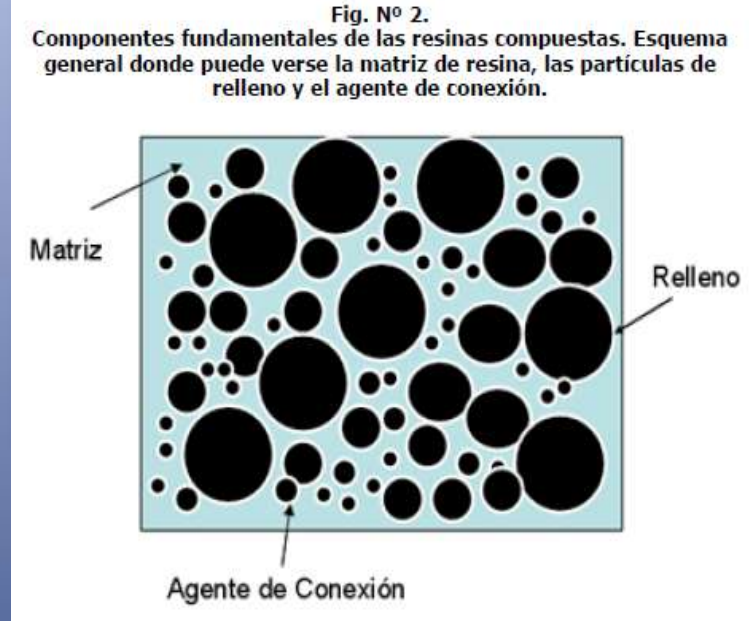
Materiales que inducen repuestas favorables.

Las partículas de relleno.

El tamaño reducido mejoro la capacidad de pulido y aumentó la resistencia abrasiva

Existen tres componentes estructurales básicos en los composites dentales:

- Matriz.
- Partículas de relleno.
- Agente de acoplamiento.



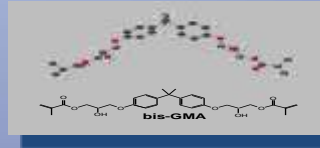
RODRIGUEZ G. Douglas R. Profesor Asociado en la asignatura Biomateriales Odontológicos del Departamento de Ciencias Básicas Odontológicas de la Facultad de Odontología de la Universidad de Carabobo.

PEREIRA S. Natalie A. Profesora contratada en la asignatura Operatoria Dental del Departamento de Prosthodontia y Oclusión de la Facultad de Odontología de la Universidad de Carabobo

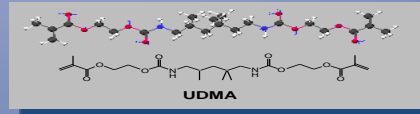
Matriz

Los tres monómeros más ampliamente usados para matrices basados en dimetacrilatos

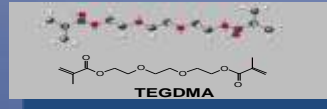
– bis-GMA (PM 512)



– UEDMA (PM 470)



– TEGDMA (PM 286) (se usa como el diluyente)



– Variaciones

Influence of UEDMA, BisGMA and TEGDMA on selected mechanical properties of experimental resin composites

Erik Asmussen, Anne Peutzfeldt

ABSTRACT

Objectives. This study was conducted to determine the effect of UEDMA, BisGMA and TEGDMA on selected mechanical properties of experimental resin composites.

Methods. Thirty monomer mixtures of TEGDMA and BisGMA and/or UEDMA were produced. Five base monomer mixtures had the following molar relationships between TEGDMA and BisGMA: 30:70, 40:60, 50:50, 60:40 and 70:30. Monomer mixtures were then produced in which BisGMA was successively substituted by UEDMA, 10 mol% at a time. The resins were made light-curing and loaded with filler. Diametral tensile strength, flexural strength and modulus of elasticity were determined on 1 week old specimens. The results were analyzed by ANOVA and by response surface methodology.

Results. The diametral tensile strength of the resin composites varied between 52 and 59 MPa, the flexural strength between 137 and 167 MPa, and the modulus of elasticity between 8.0 and 11.1 GPa. The statistical analyses showed that substitution of BisGMA or TEGDMA by UEDMA resulted in an increase in tensile and flexural strength, and that substitution of BisGMA by TEGDMA increased tensile, but reduced flexural strength. Further, it was found that, for a given content of UEDMA, variations in the ratio BisGMA/TEGDMA gave rise to a maximum in modulus of elasticity. The size of this maximum in modulus decreased with increasing content of UEDMA.

Significance. Varying the relative amounts of UEDMA, BisGMA and TEGDMA has a significant effect on the mechanical properties of the resin composition. Thus, by selecting specific combinations of these components, it may be possible to design composites with properties that are tailor made to specific applications.

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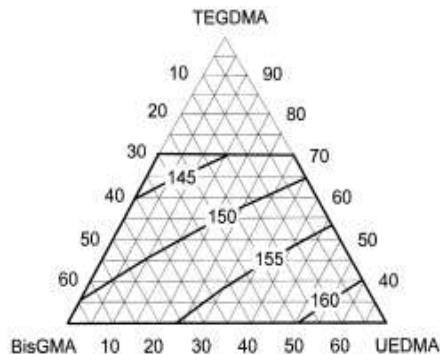


Fig. 2. Relationship between flexural strength (MPa) of the resin composites and monomer composition (mol%).

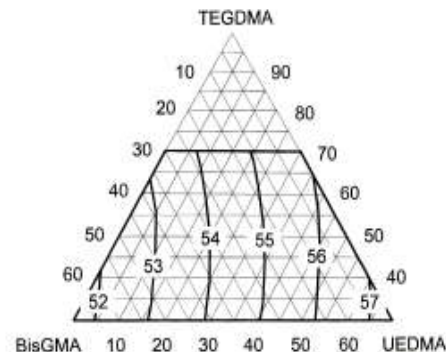


Fig. 1. Relationship between diametral tensile strength (MPa) of the resin composites and monomer composition (mol%).

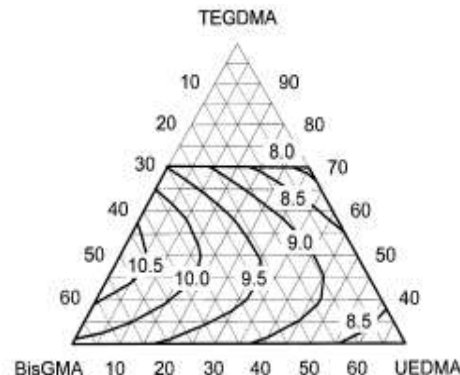
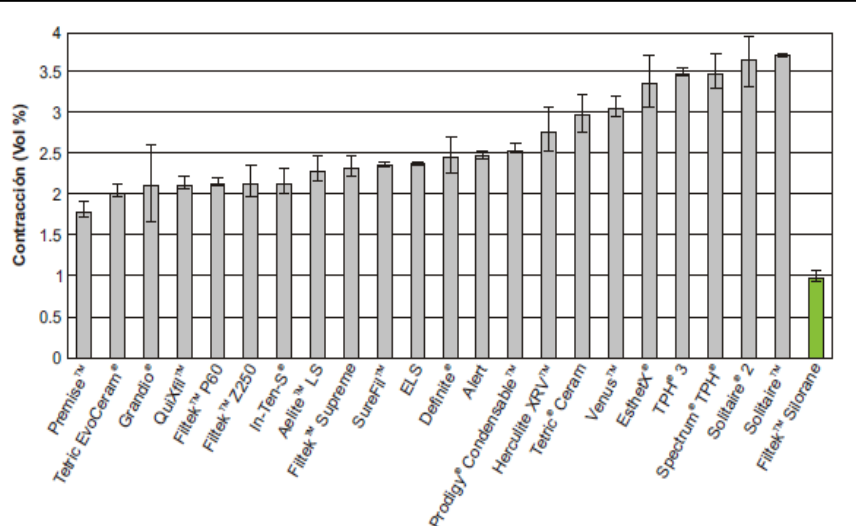
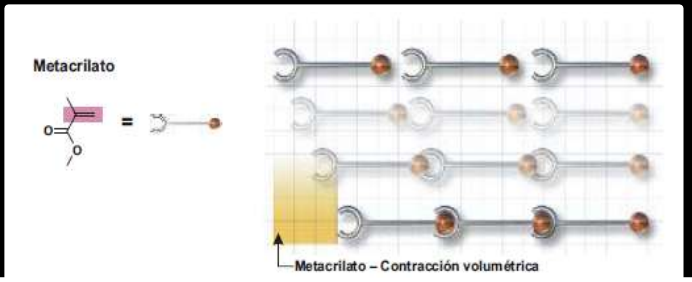
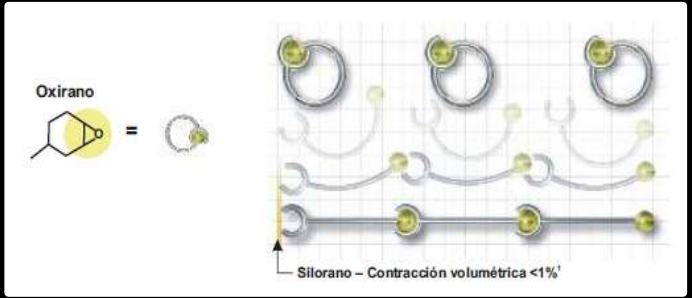
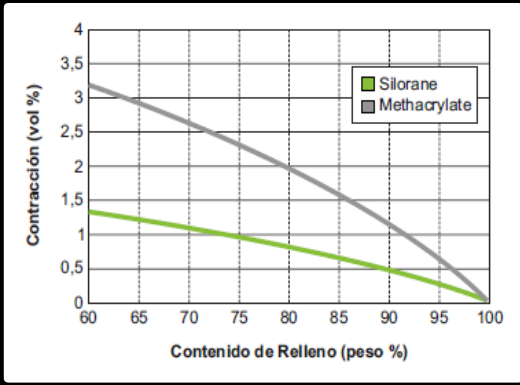
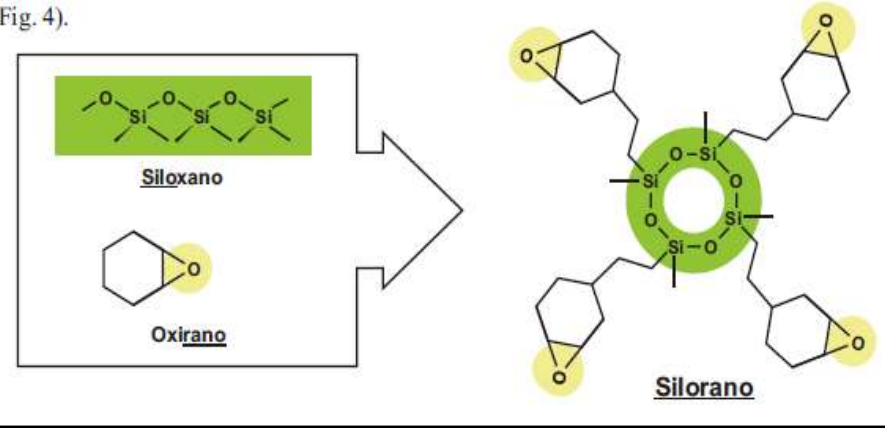


Fig. 3. Relationship between modulus of elasticity (GPa) of the resin composites and monomer composition (mol%).

“La química de los siloranes por primera vez presenta la posibilidad de valores de contracción menores al 1 %, parámetros como el módulo elástico y resistencia flexural comparable a los composites convencionales”



(Fig. 4).



¿Que hay de cierto?

1. Poseen buenas propiedades mecánicas.
2. Inferior integridad en los márgenes cuando se compara con los nanohíbridos.
3. No genera menos estrés de contracción que otras formulaciones.

1. Ilie N, Hickel R. ***Dent Mater*** 2009; 25:810–9.
Ilie N, Hickel R. ***Dent Mater J*** 2006; 25:445–54.
2. Schmidt M, Kirkevang LL, Hørsted-Bindslev P, Poulsen S. ***Clin Oral Invest*** 2010. July 20 [Epub ahead of print].
3. Marchesi G, Breschi L, Antonioli F, DiLenarda R, Ferracane J, Cadenaro M. ***Dent Mater*** 2010;26:947–53.

Contraction stress of low-shrinkage composite materials assessed with different testing systems

ABSTRACT

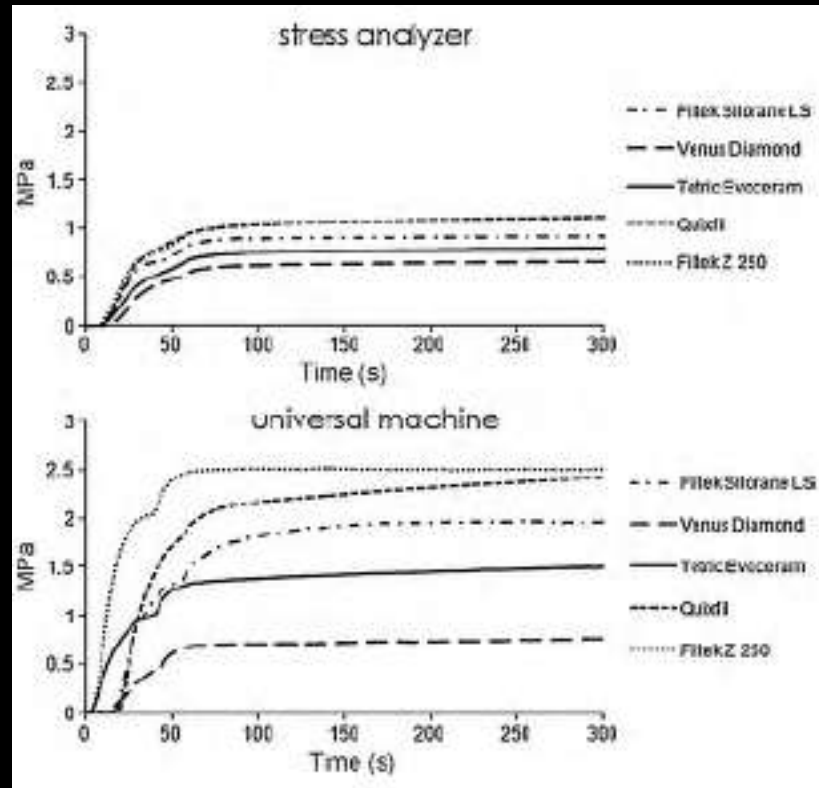
Objectives. The contraction stress of a silorane-based material and a new low-shrinkage nanohybrid composite were compared to three conventional dimethacrylate-based resin composites using two different measuring systems. It was hypothesized that the silorane-based material and the low-shrinkage nanohybrid composite would exhibit lower contraction stress than dimethacrylate-based composites irrespective of measuring system.

Methods. The materials tested were Filtek Silorane LS (3M ESPE), Venus Diamond (Heraeus Kulzer), Tetric EvoCeram (Ivoclar Vivadent), Quixfil (Dentsply DeTrey), and Filtek Z250 (3M ESPE). Shrinkage stress was assessed using a stress-strain analyzer consisting of two opposing attachments, one connected to a load sensor and the other fixed to the device, or a system fixed to a universal testing machine with an extensometer as a feedback system. All specimens were light-cured with 20 J/cm^2 ; the contraction force (N) generated during polymerization was continuously recorded for 300 s. Contraction stress (MPa) was calculated at both 40 s and 300 s. Data were statistically analyzed by three-way ANOVA and Tukey's post hoc test ($\alpha = 0.05$).

Results. Venus Diamond exhibited the lowest stress under both experimental conditions. Stress values scored as follows: Venus Diamond < Tetric EvoCeram < Filtek Silorane LS < Quixfil < Filtek Z250 ($p < 0.05$). Stress values measured with the stress-strain analyzer were significantly lower than those measured with the universal testing machine with feedback.

Significance. The hypothesis was partially rejected because only Venus Diamond exhibited the lowest stress values among the tested materials. Contraction stress was higher for all composites when measured in a test system with a feedback. This study confirms that simply reducing the shrinkage does not ensure reduced stress development in composites.

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Giulio Marchesi^a, Lorenzo Breschi^{a,b,*}, Francesca Antonioli^a, Roberto Di Lenarda^a, Jack Ferracane^c, Milena Cadenaro^a

Otras filosofías adoptadas para disminuir la contracción:

1. Aumentar el peso molecular del monómero para reducir la contracción.
2. Monómeros con baja generación de estrés.
3. Monómeros con un mayores niveles conversión.

1. DX511 (895 g/mole), en KALORE™, GC



2. TCD-DI-HEA, en Venus Diamond, Kulzer



3. Dimer acid monomer (673-849 g/mole), en N' Durance, Septodont

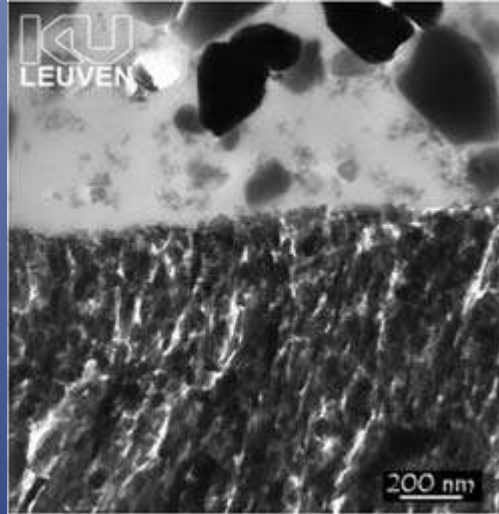
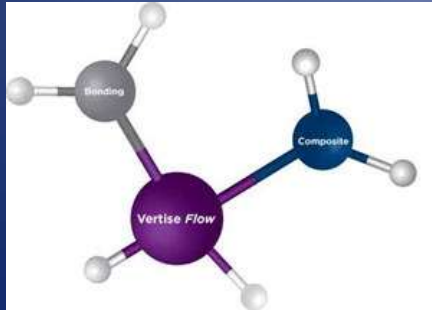




Resinas fluidas que contienen monómeros ácidos:



- Vertise Flow (Kerr)
- Fusio™ Liquid Dentin (Penton Clinical)
- Usan los metacrilatos típicos con un monómero ácido (GPDM) capaz de generar adhesión mecánica y posiblemente química.
- Usos: forros, sellantes y restauraciones pequeñas.



Vertise Flow
Self-Adhering Flowable
Composite

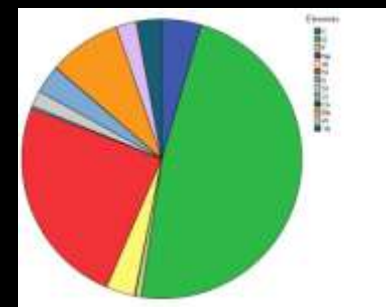
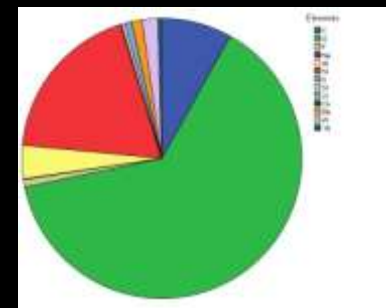
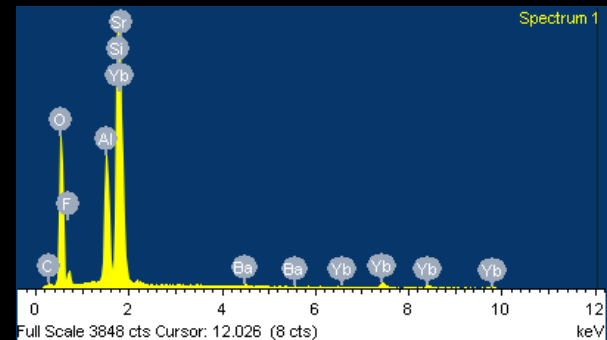
“Actualmente se han desarrollado formulaciones de monómeros con reducida contracción de polimerización, que generan menor estrés y algunos con propiedades autoadhesivas”

Partículas de Relleno

Química de las Partículas de Relleno.

- Oxido de Silice
- Cuarzo ó vidrio molido de 0.1 a 100 micras.
- Sílice coloidal ó piro-lítica 0.04 micras (40 nanómetros av).
- Óxidos de aluminio, zirconio y litio.
- Óxidos de bario, zinc, boro e itrio.
- Tri-fluoruro de iterbio.

	C	O	F	Na	Al	Si	K	Sr	Zr	Co	Ba	W	Yb
VitLescenceD	P	P	—	—	P	P	—	—	—	—	P	P	—
TPH3	P	P	—	—	P	P	—	—	—	—	P	—	—
Point4	P	P	—	—	P	P	—	—	—	P	P	—	—
AmelogenP	P	P	—	—	P	P	—	—	—	—	P	—	—
EsthetXHD	P	P	—	—	P	P	—	—	—	P	P	—	—
ROK	P	P	—	—	P	P	—	—	—	—	—	P	—
Heliomolar	P	P	P	—	—	P	—	—	—	—	—	—	P
P60	P	P	—	P	P	P	—	—	P	—	—	—	—
Premise	P	P	—	—	P	P	—	—	—	—	P	—	—
ice	P	P	—	—	P	P	—	P	—	—	—	P	—
Grandio	P	P	—	—	P	P	—	—	—	—	P	P	—
Brillante	P	P	—	—	P	P	—	—	—	—	P	—	—
VitLescenceE	P	P	—	—	P	P	—	P	—	—	P	P	—
TetricNceram	P	P	P	—	P	P	—	—	—	—	P	—	P
Z100	P	P	—	—	—	P	—	—	P	—	—	—	—
Z250	P	P	—	—	P	P	—	—	P	—	—	—	—
SOLARE	P	P	—	P	P	P	P	—	—	—	—	—	—
Z350	P	P	—	—	P	P	—	—	P	—	—	—	—
KALORE	P	P	P	—	P	P	—	P	—	—	P	—	P

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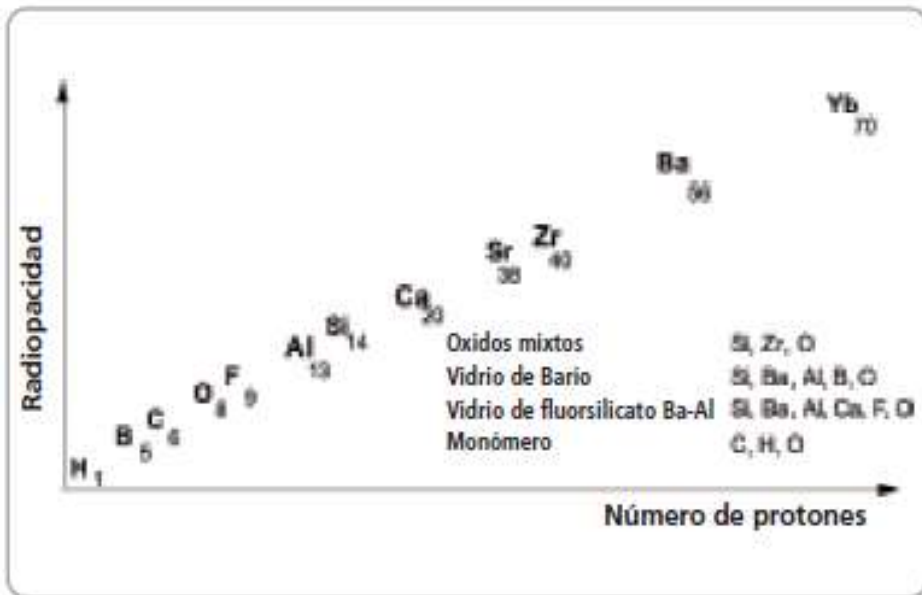


Fig. 3: Relación cualitativa entre la radiopacidad y el número atómico.

Ivoclar/vivadent

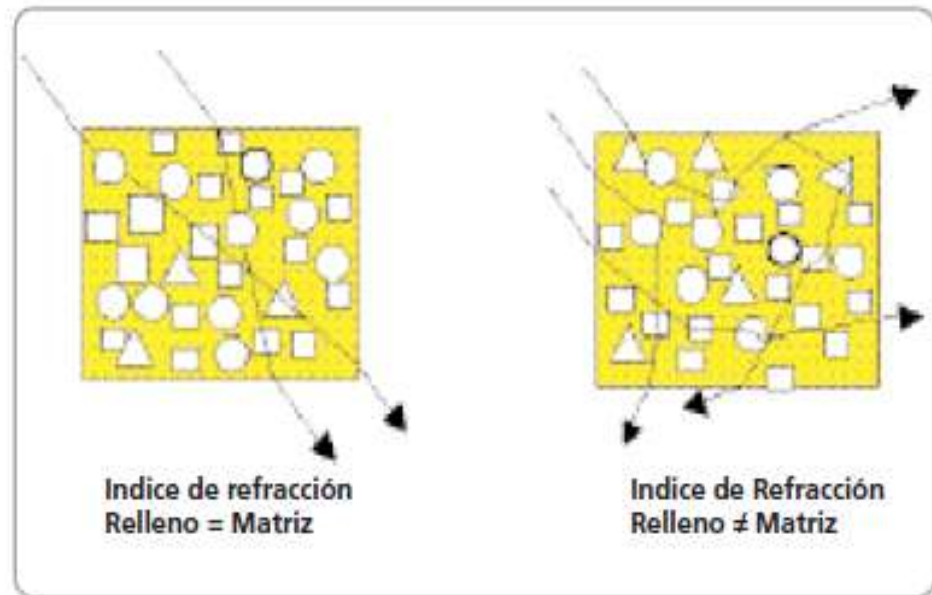


Fig. 4: Ilustración que muestra por qué diferencias en el índice de refracción de la matriz de monómero y del relleno dan como resultado composites opacos.

Beneficios de las partículas de relleno

Reforzamiento de la matriz de resina
resultado en aumento de la dureza,
resistencia y disminuyendo el
desgaste.

Reducción de la
contracción de
polimerización a 1,5 - 4
vol%.

Reduce la contracción
y expansión térmica.

Mejorando la manipulación
por incremento de la
viscosidad hasta convertir la
matriz en una pasta
manipulable.

Reduce la absorción
de agua y
pigmentado.

Al incorporar metales
pesados en su
composición mejoran la
sensibilidad del
diagnostico radiográfico.

Agente de acoplamiento

Silanos orgánicos γ -
metacriloxipropiltrimetoxisilano:

- La unión entre la matriz y el relleno, esta dada por el agente de acoplamiento.

Representa del 4,4 – 9,7% de la resina compuesta

Journal of Oral Rehabilitation 2004 **31**; 1090–1101

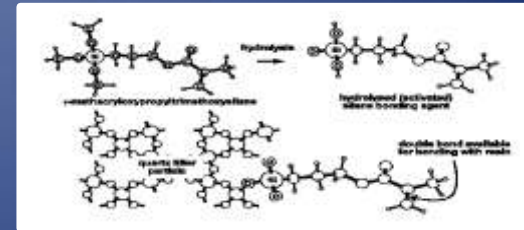
J. SABBAGH*, L. RYELANDT[†], L. BACHÉRIUS[†], J.-J. BIEBUYCK[‡], J. VREVEN*,
P. LAMBRECHTS[§] & G. LELOUP* *Department of Conservative Dentistry, School of Dentistry, Université Catholique

**Dentro de las ventajas que se
obtienen del agente de
acoplamiento podemos
nombrar:**

1. Mejora propiedades físicas y mecánicas.

2. Inhibe la penetración de agua en la interfase matriz- relleno.

3. Esta relacionado con el éxito clínico de la restauración.



Iniciador-Activador

Físicos

Químicos

Calor Q

Luz

I=peroxido de benzoilo + A= 2% amina terciaria aromática

Lucirin TPO

I=camforoquina
0,06% + A=amina terciaria no aromática 0,01%)

PPD

Irgacure 819

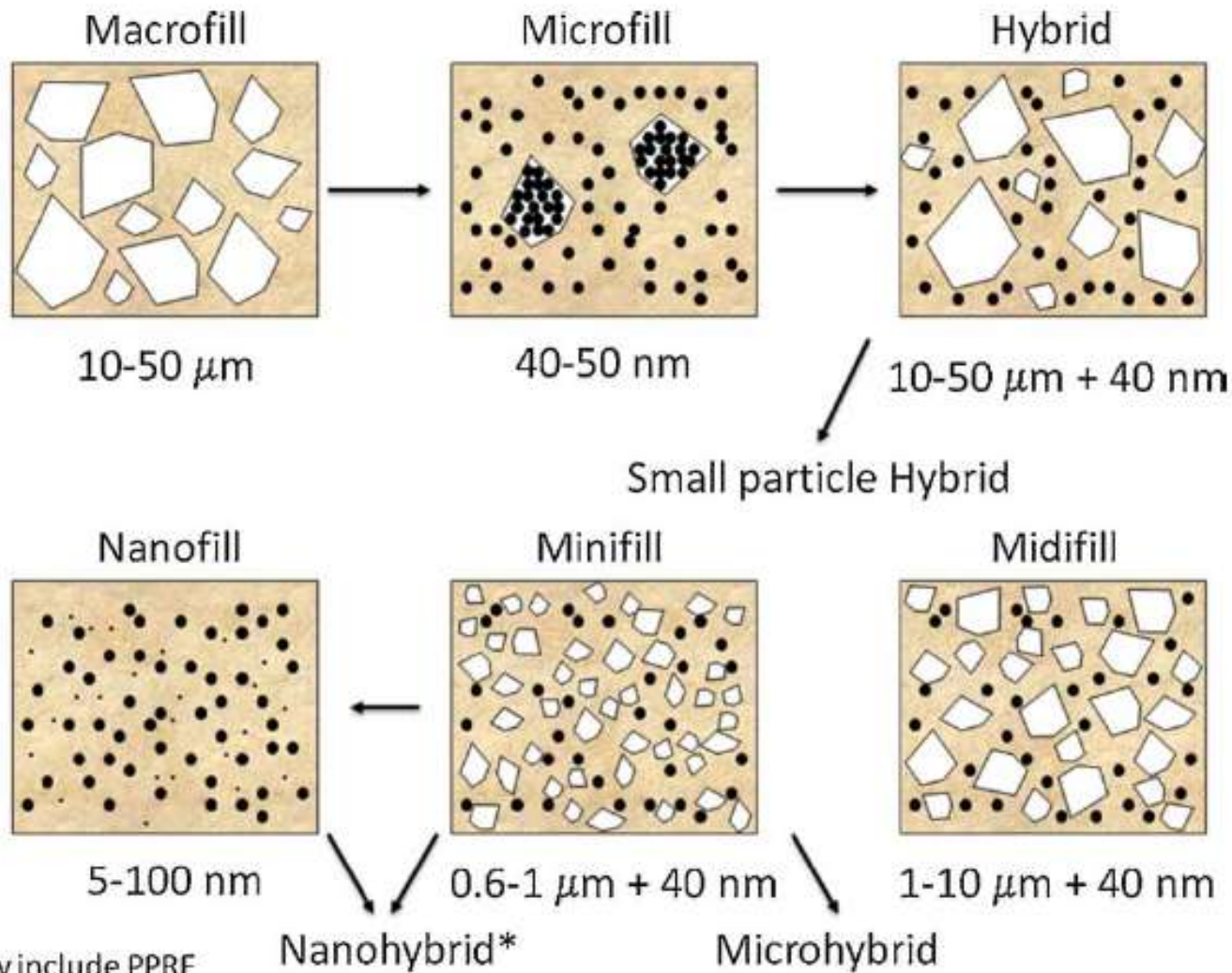
OPPI
"experimental"

Otros componentes:

- inhibidores (hidroxitolueno butilado)
- modificadores ópticos (pigmentos, opacificadores y tipos de relleno)



**Clasificación de las resinas
compuestas en relación al
tamaño y distribución de
las partículas.**



*may include PPRF

4

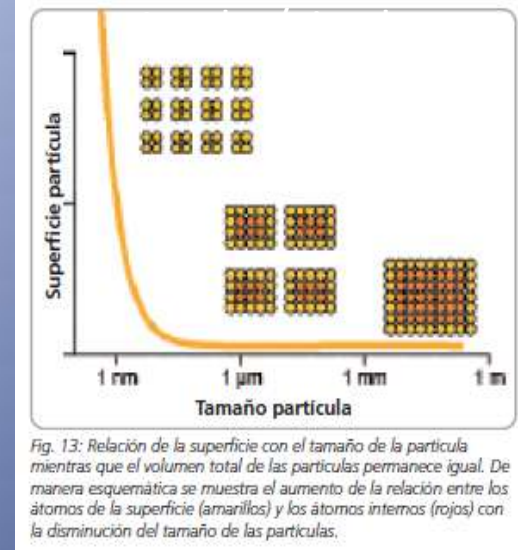


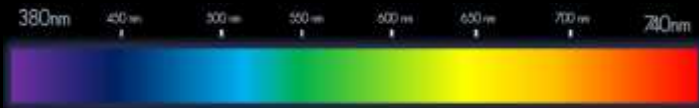
Matriz

8



16





0.025-0.075 μm
nano-rellenos

0.4 – 0.7 μm Luz visible

0.04 – 0.4 μm micro-rellenos

0.4 – 1 μm microhíbrida

0.5 – 3 μm híbrida

Nano-híbrido

¿Por que es difícil diferenciar los composites?

Nano-híbridos y Nano-rellenos vs. Micro-híbridos

1. Poseen similares propiedades mecánicas.
 2. Estabilidad en almacenamiento en agua, con datos contradictorios.
 3. Similar susceptibilidad al envejecimiento.
 4. Bajas propiedades mecánicas en las formulaciones que incorporan pre-polímeros.
 5. Similares resultados en restauraciones C2 en periodos de 2 y 4 años.
1. Ilie N, Hickel R. ***Clin Oral Invest*** 2009. ADA Restor Mater 2010.
 2. Ilie N, Hickel R. ***Dent Mater*** 2009. Curtis AR, Palin WM, Fleming GJ, Shortall AC, Marquis PM. ***Dent Mater*** 2009.
 3. Hahnel S, Henrich A, Bürgers R, Handel G, Rosentritt M. ***Oper Dent*** 2010.
 4. Blackham JT, Vandewalle KS, Lien W. ***Oper Dent*** 2009.
 5. Ernst CP, Brandenbusch M, Meyer G, Canbek K, Gottschalk F, Willershausen B. ***Clin Oral Invest*** 2006. Kramer N, Reinelt C, Richter G, Petschelt A, Frankenberger R. ***Dent Mater*** 2009.

**Clasificación de las resinas
compuestas en relación
a la morfología de las
partículas del relleno.**

The effect of filler loading and morphology on the mechanical properties of contemporary composites

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College of Dentistry, Kyungpook National University, Taegu, Korea; University of Texas Health Science Center at San Antonio, Texas; and Graduate School of Dentistry, Tohoku University, Sendai, Japan

Statement of problem. Little information exists regarding the filler morphology and loading of composites with respect to their effects on selected mechanical properties and fracture toughness.

Purpose. The objectives of this study were to: (1) classify commercial composites according to filler morphology, (2) evaluate the influence of filler morphology on filler loading, and (3) evaluate the effect of filler morphology and loading on the hardness, flexural strength, flexural modulus, and fracture toughness of contemporary composites.

Material and methods. Field emission scanning electron microscopy/energy dispersive spectroscopy was used to classify 3 specimens from each of 14 commercial composites into 4 groups according to filler morphology. The specimens (each $5 \times 2.5 \times 15$ mm) were derived from the fractured remnants after the fracture toughness test. Filler weight content was determined by the standard ash method, and the volume content was calculated using the weight percentage and density of the filler and matrix components. Microhardness was measured with a Vickers hardness tester, and flexural strength and modulus were measured with a universal testing machine. A 3-point bending test (ASTM E-399) was used to determine the fracture toughness of each composite. Data were compared with analysis of variance followed by Duncan's multiple range test, both at the $P < .05$ level of significance.

Results. The composites were classified into 4 categories according to filler morphology: prepolymerized, irregular-shaped, both prepolymerized and irregular-shaped, and round particles. Filler loading was influenced by filler morphology. Composites containing prepolymerized filler particles had the lowest filler content (25% to 51% of filler volume), whereas composites containing round particles had the highest filler content (59% to 60% of filler volume). The mechanical properties of the composites were related to their filler content. Composites with the highest filler by volume exhibited the highest flexural strength (120 to 129 MPa), flexural modulus (12 to 15 GPa), and hardness (101 to 117 VHN). Fracture toughness was also affected by filler volume, but maximum toughness was found at a threshold level of approximately 55% filler volume.

Conclusion. Within the limitations of this study, the commercial composites tested could be classified by their filler morphology. This property influenced filler loading. Both filler morphology and filler loading influenced flexural strength, flexural modulus, hardness, and fracture toughness. (J Prosthet Dent 2002;87:642-9.)

CLINICAL IMPLICATIONS

In this in vitro study, filler morphology greatly influenced filler loading, which in turn affected the mechanical properties of the composites tested.

Table III. Mechanical properties of tested composites

Group	Product	Filler morphology	Flexural strength (MPa) ^a	Flexural modulus (GPa) ^a	VHN ^a	Fracture toughness K _{IC} (MPa√m) ^a
1	Metafil CX	Pre-polymerized particles	75 ± 2 ^{HI}	3.4 ± 0.6 ^I	26 ± 1 ^I	0.63 ± 0.01 ^G
	Silux Plus		59 ± 2 ^{GI}	6.8 ± 0.4 ^G	49 ± 3 ^{HI}	0.81 ± 0.07 ^F
	Heliomolar Radiopaque		78 ± 3 ^{HI}	5.5 ± 0.4 ^{HI}	36 ± 2 ^I	0.84 ± 0.02 ^E
	Palfique Estelite		74 ± 2 ^{HI}	6.7 ± 0.5 ^G	57 ± 3 ^G	0.85 ± 0.01 ^E
2	Aelitefil	Irregular-shaped particles	123 ± 2 ^B	11.6 ± 1.2 ^{BC}	89 ± 5 ^C	0.98 ± 0.03 ^C
	Charisma		113 ± 3 ^{DE}	10.2 ± 0.9 ^{DE}	79 ± 4 ^{DE}	0.75 ± 0.02 ^F
	Herculite XR		125 ± 3 ^{AB}	10.4 ± 0.9 ^{DE}	77 ± 4 ^F	0.85 ± 0.01 ^F
	Hipolite		109 ± 3 ^F	11.4 ± 1.2 ^{BCD}	56 ± 2 ^G	1.14 ± 0.07 ^A
	TPH		116 ± 4 ^{DC}	9.6 ± 0.8 ^F	60 ± 2 ^G	1.04 ± 0.04 ^B
Veridontil	114 ± 3 ^{DE}	11.6 ± 0.9 ^{BC}	64 ± 3 ^F	1.08 ± 0.03 ^B		
3	Photoclearfil	Pre-polymerized + irregular-shaped particles	80 ± 2 ^C	8.4 ± 1.0 ^F	63 ± 2 ^F	0.91 ± 0.07 ^D
	Pertac-Hybrid		109 ± 3 ^{EF}	11.0 ± 0.9 ^{CD}	81 ± 3 ^D	1.06 ± 0.08 ^B
4	Z-100	Round particles	129 ± 5 ^A	15.0 ± 1.3 ^A	117 ± 5 ^A	0.97 ± 0.04 ^C
	Palfique Toughwell		120 ± 3 ^{BC}	12.3 ± 1.3 ^B	101 ± 4 ^B	0.96 ± 0.03 ^D

Within each column, values marked with the same capital letter were not significantly different (Duncan's multiple range test, $P < 0.05$).
^aSignificantly different (1-way ANOVA, $P < 0.05$).

CONCLUSIONS

Within the limitations of this study, composites could be classified by their filler morphology. Composites that contained prepolymerized filler particles had the lowest filler loading and therefore the lowest flexural properties and hardness. Composites that contained round filler particles had the highest filler loading, resulting in the highest flexural properties and hardness. Composites that contained either irregular-shaped or a mixture of prepolymerized and irregular-shaped filler particles had intermediate filler loading, flexural properties, and hardness. High filler loading was not associated with high fracture toughness.

Experimentación

5 muestras por cada composite.

Group and Composite

G1 Heliomolar®

G2 Filtek™ Z350

G3 Tetric® N Ceram

G4 Point 4™

G5 Premisa™

G6 Esthet.X® HD

G7 ice

G8 Vit-L-escence®

G9 Grandio®

G10 TPH®3

G11 Amelogen® Plus

G12 Brilliant Enamel

G13 Filtek™ Z100

G14 ROK

G15 Solare

G16 KALORE™

G17 Filtek™ Z250

G18 Filtek™ P60



Procedimiento para clasificar los composites según morfología.

A cada porción de composite, sin polimerizar y en forma de cono, se le colocaron tres gotas de acetona, e inmediatamente se polimerizaron por 40 seg.



Esas muestras se prepararon para observación en el microscopio electrónico de barrido (SEM) ZEISS Supra 40 (CMA-UBA)



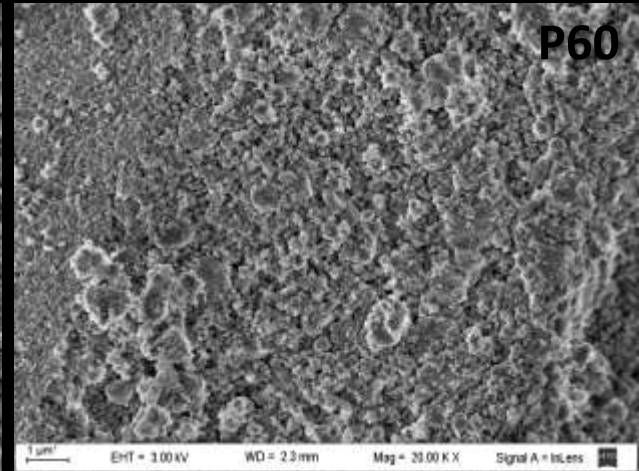
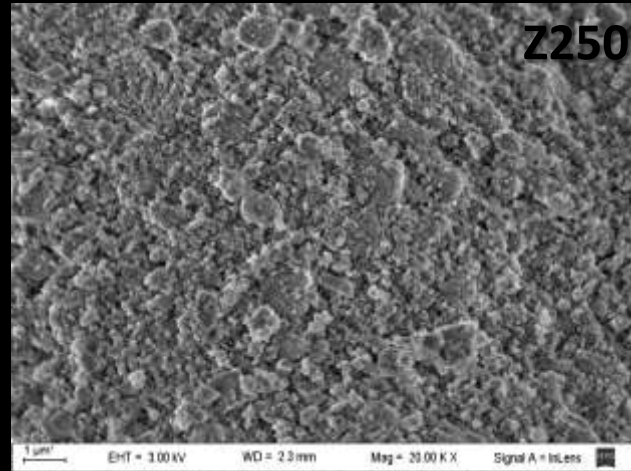
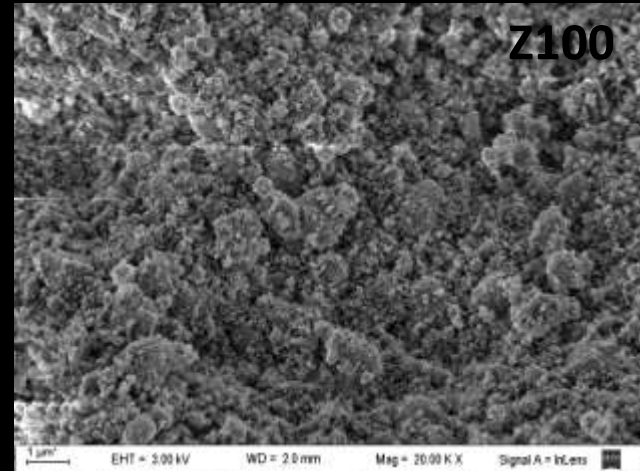
Se obtuvieron microscopias en varios aumentos (2000x, 10000x y 20000x) para su posterior análisis.



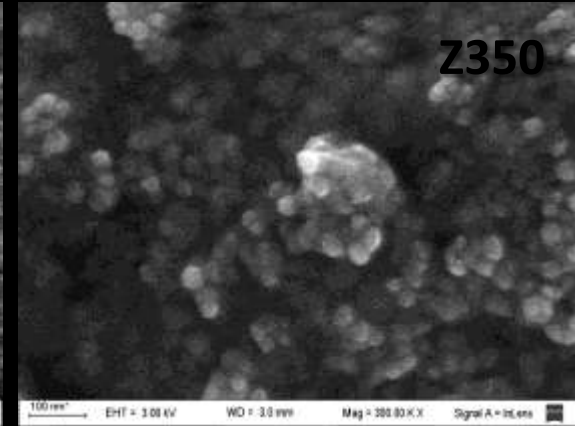
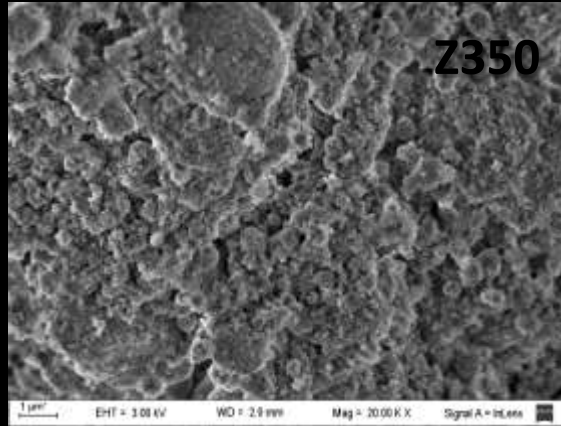
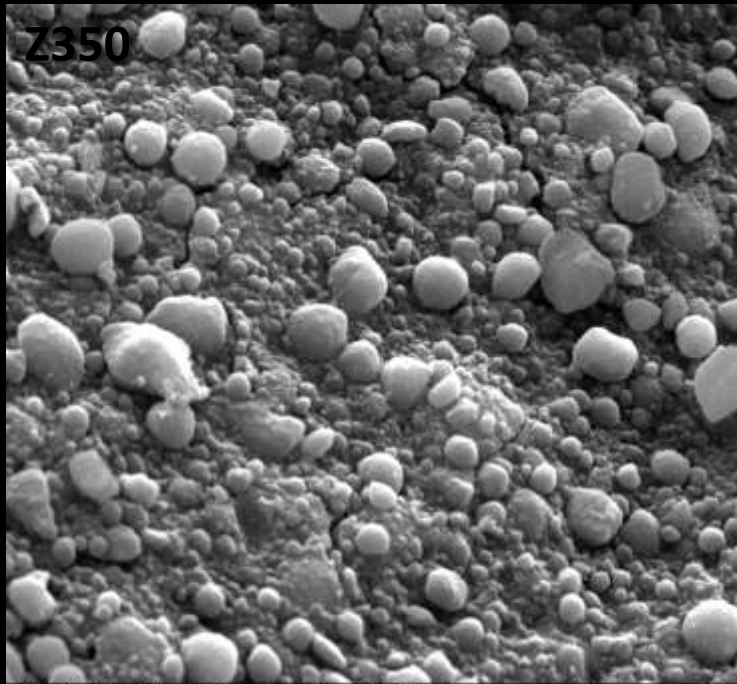
Resultado= 5 Formas:

- Esféricas
- Conglomerados esféricos
- Irregulares
- Pre – Polímeros
- Irregulares + Pre – polímeros

Relleno esférico.

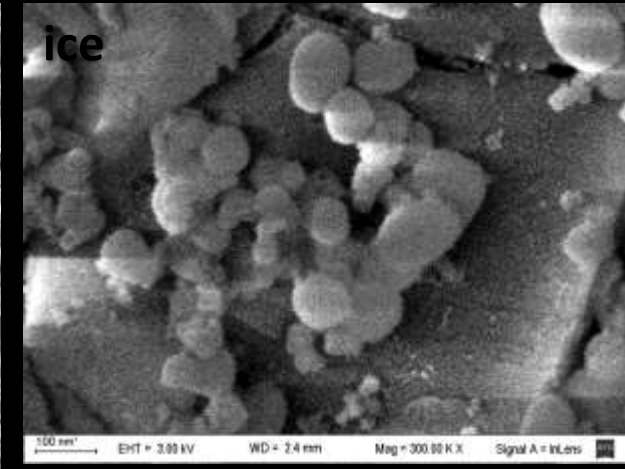
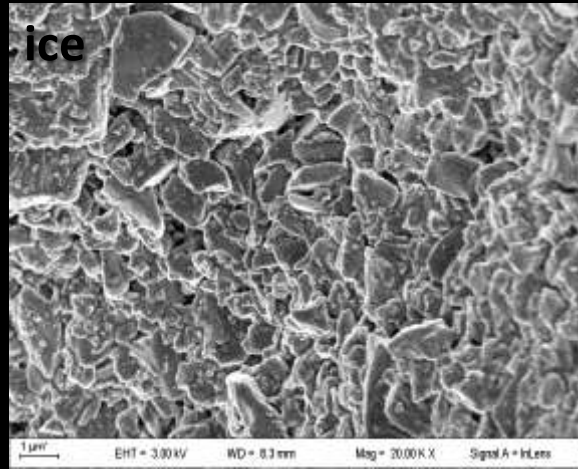
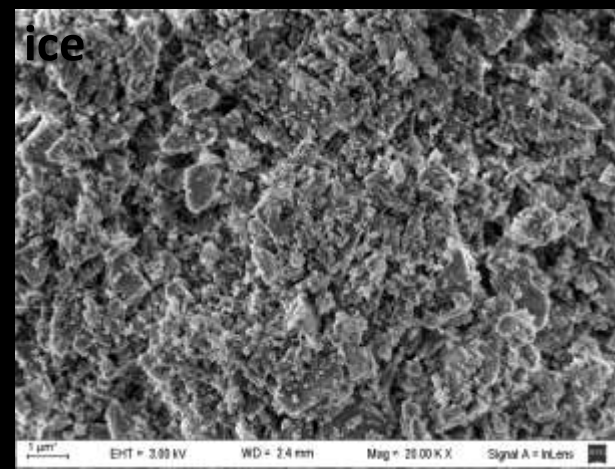
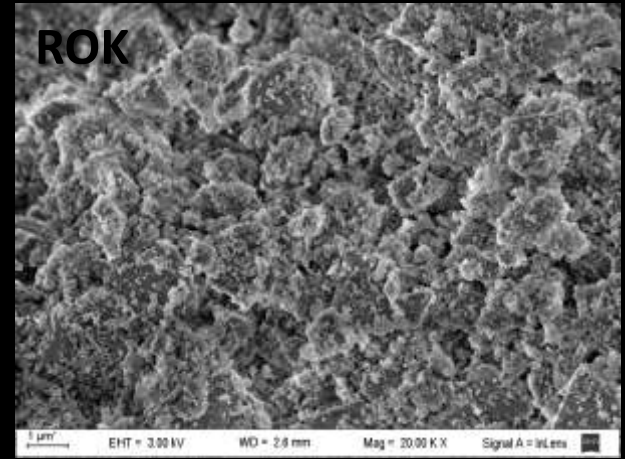
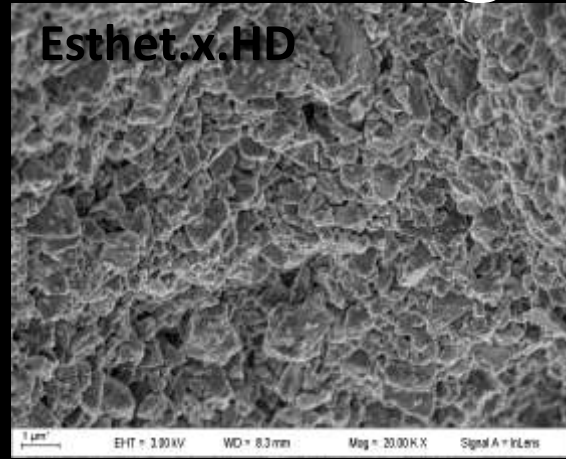
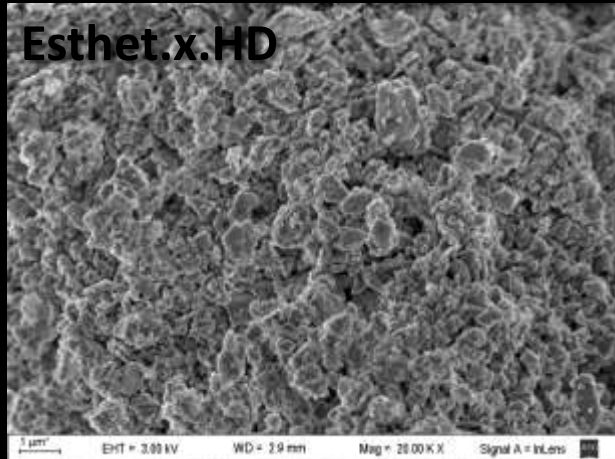


Relleno de conglomerados esféricos

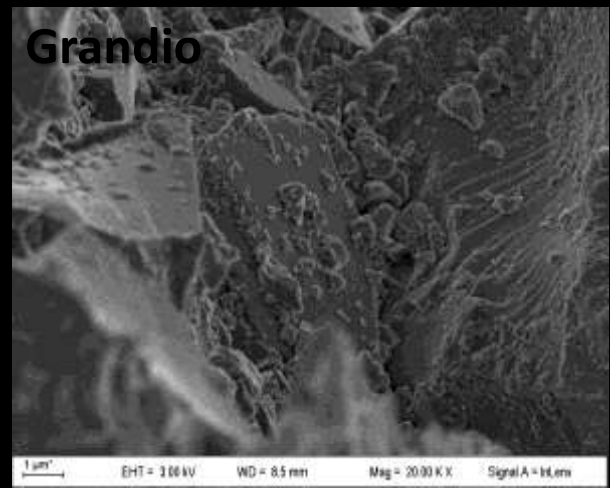
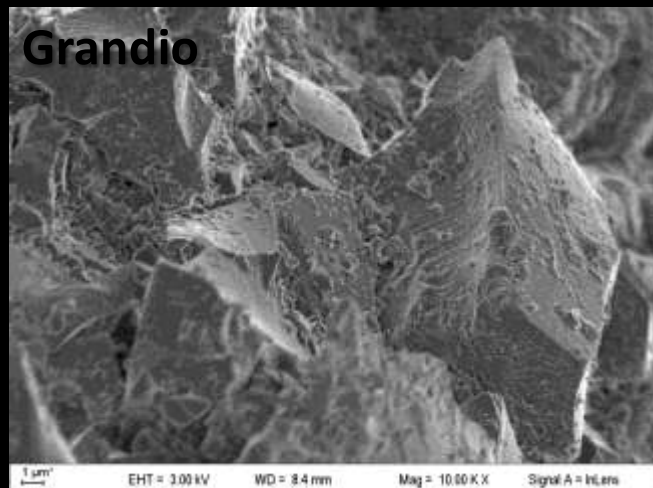
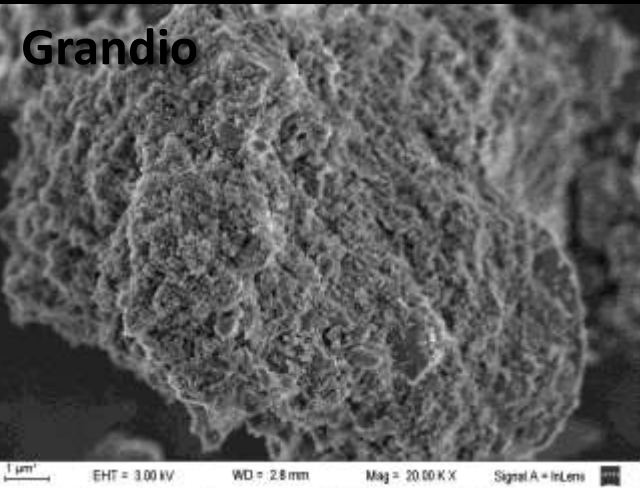
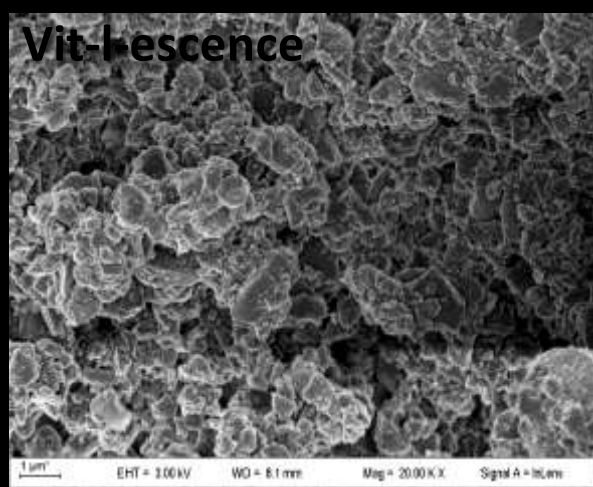
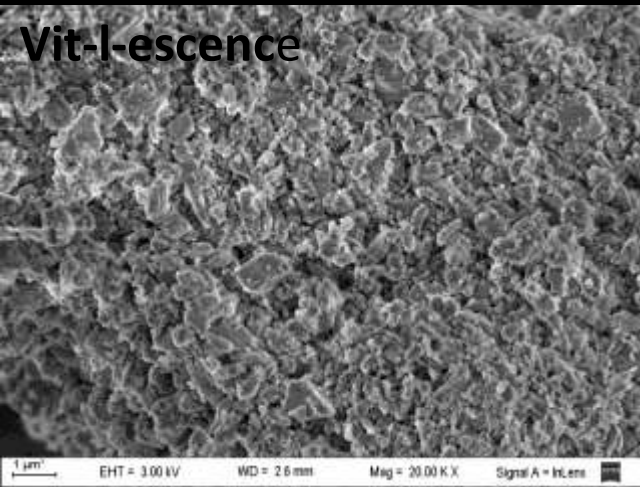


6/25/2009 HV mag WD mode spot
3:59:37 PM 25.00 kV 10 000 x 10.6 mm SE 3.5
10 μm
CNEAMAT - GME

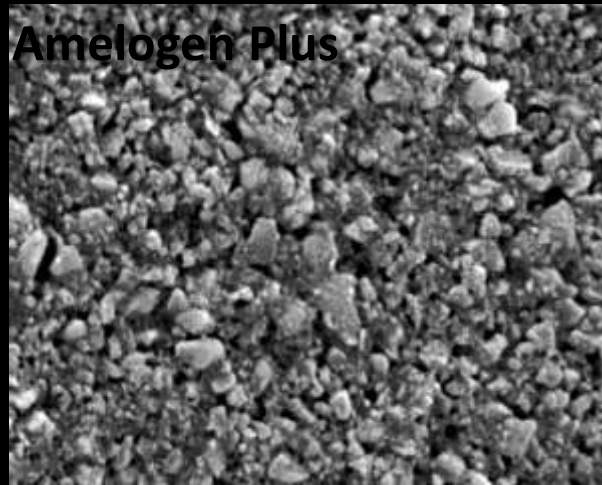
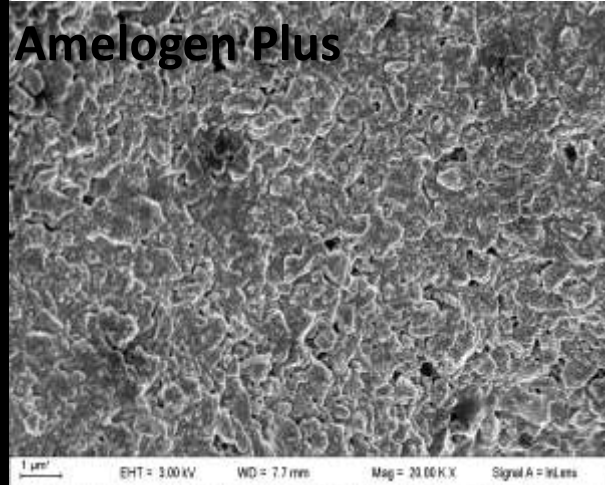
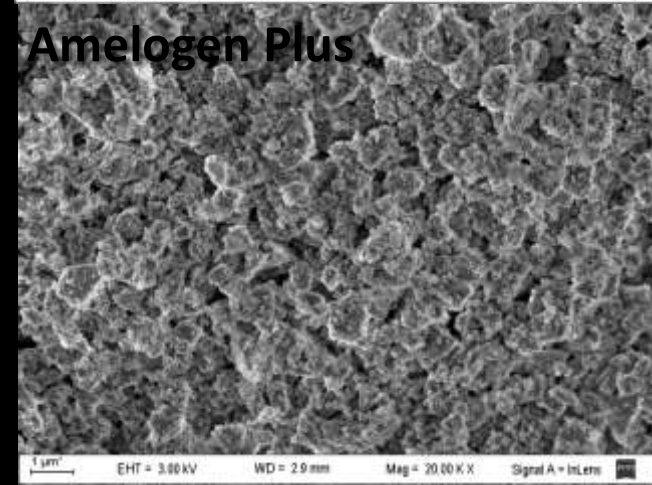
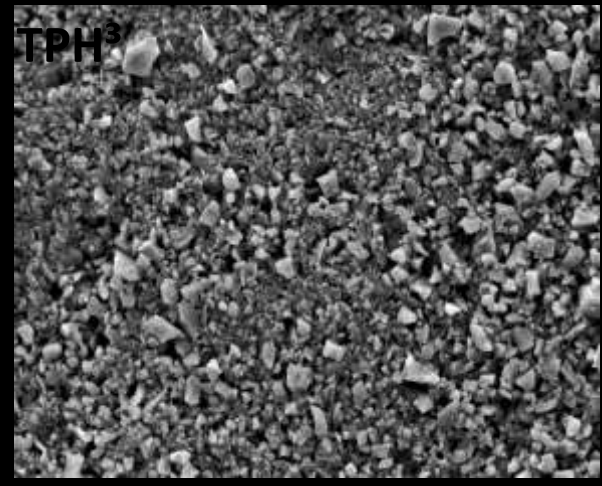
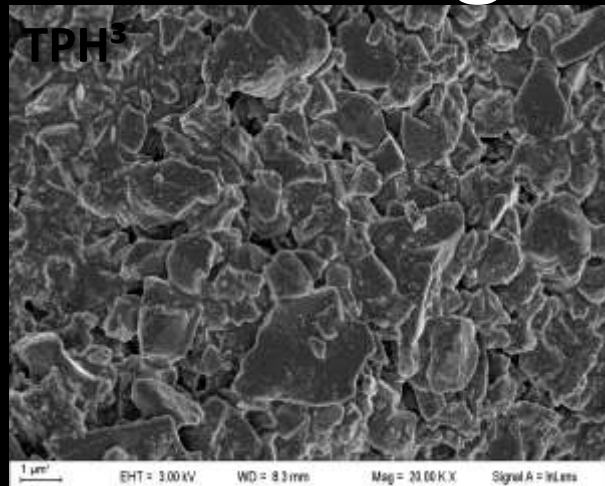
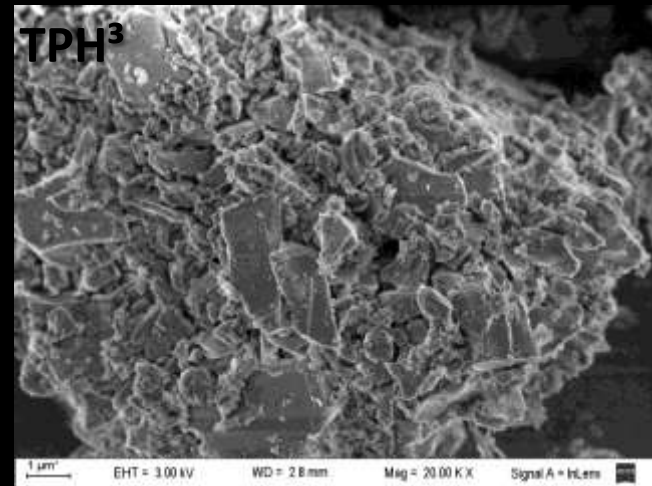
Relleno Irregular



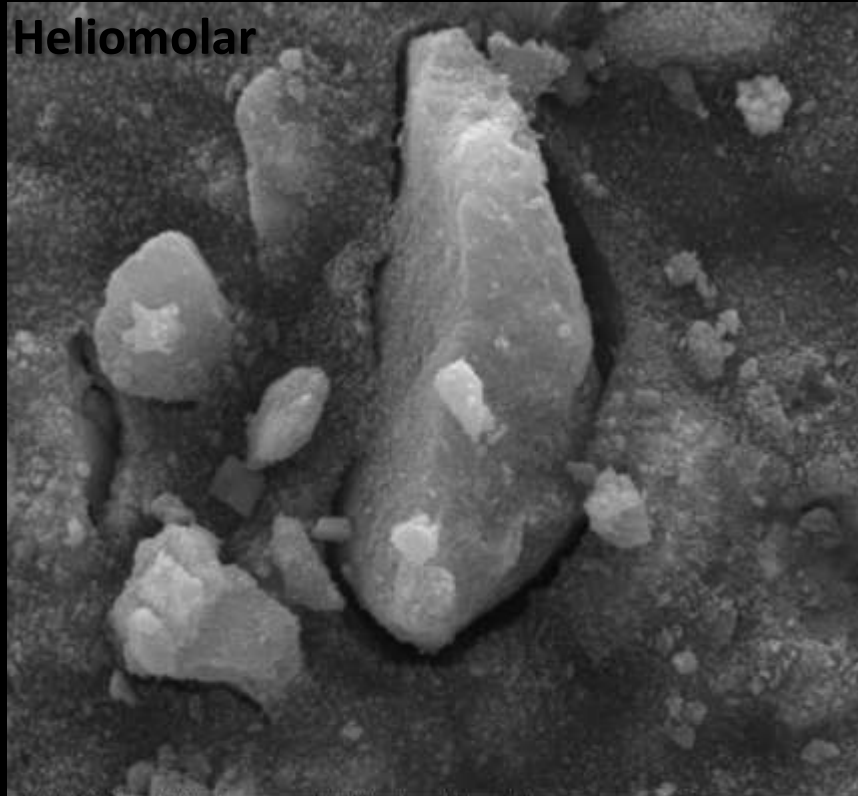
Relleño Irregular



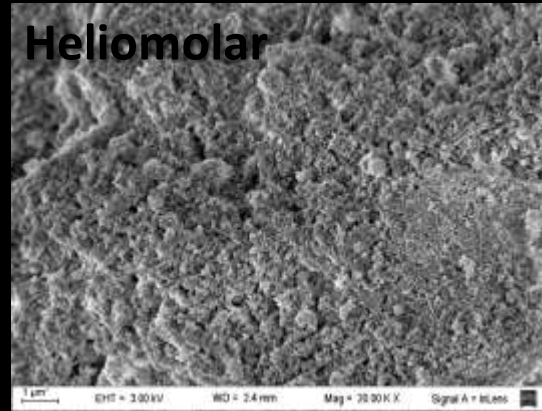
Relleno Irregular



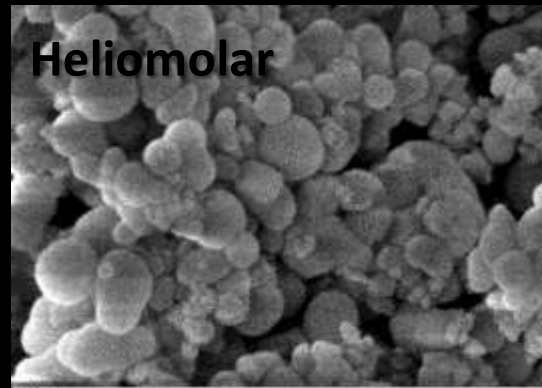
Releno Pre – Polimerizado



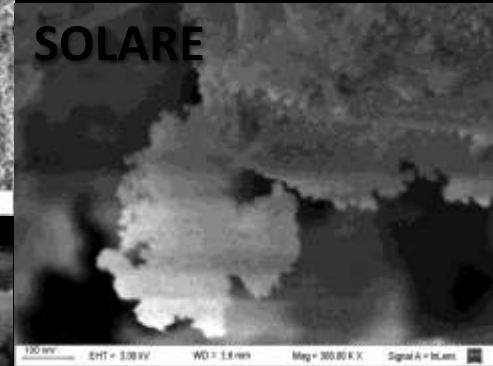
6/25/2009 HV mag WD mode spot
3:46:54 PM 25.00 kV 10 000 x 8.9 mm SE 3.5
10 µm
CNEAMAT - GME



1 µm EHT = 3.00 kV WD = 2.4 mm Mag = 20 000 X Signal A = InLens

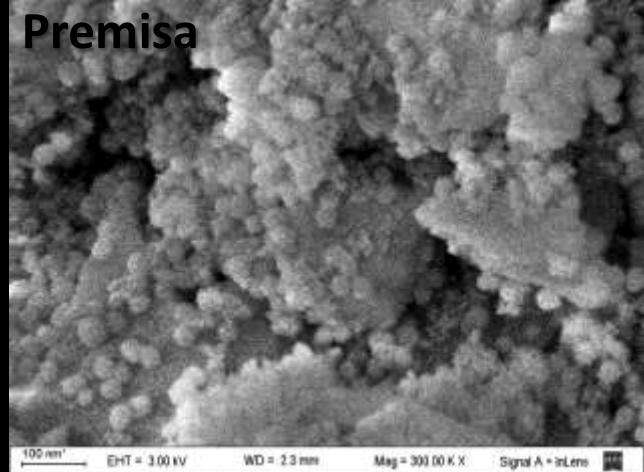
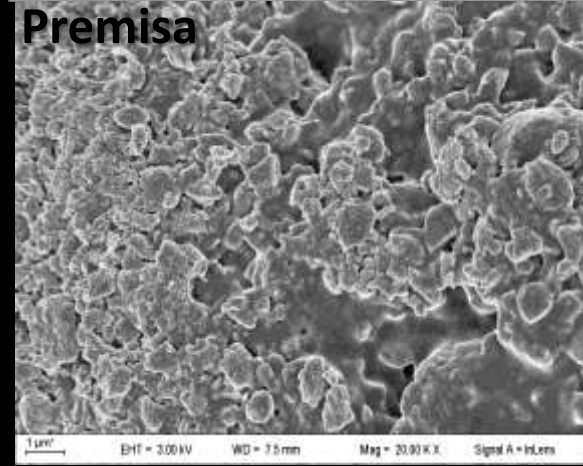
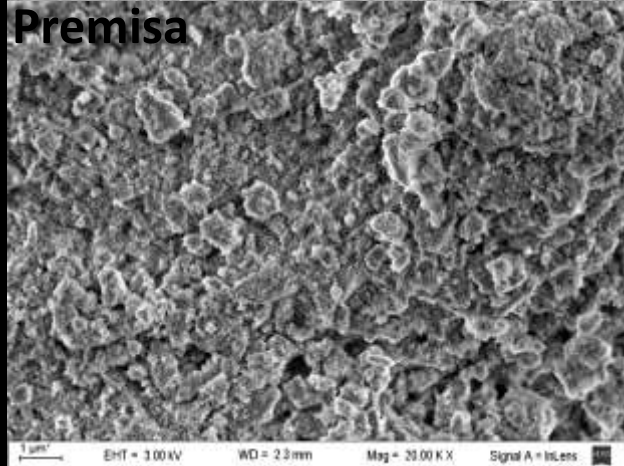
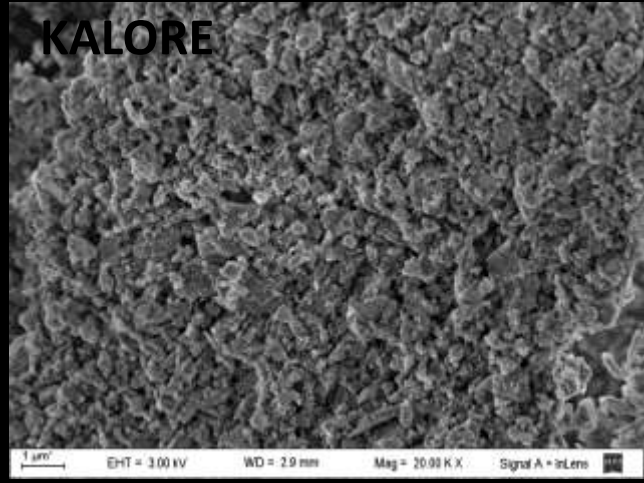
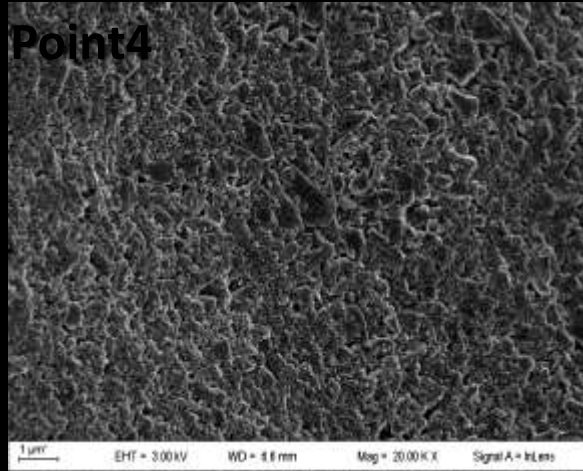
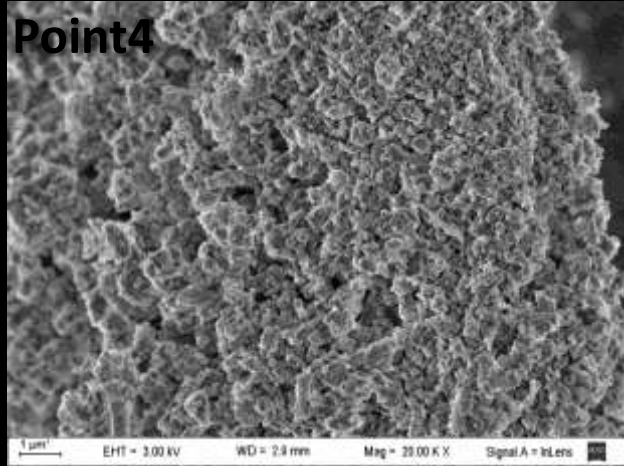


100 nm EHT = 3.00 kV WD = 2.4 mm Mag = 30 000 X Signal A = InLens

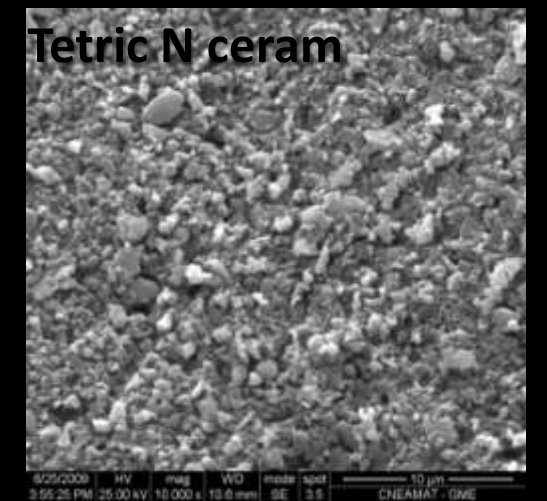
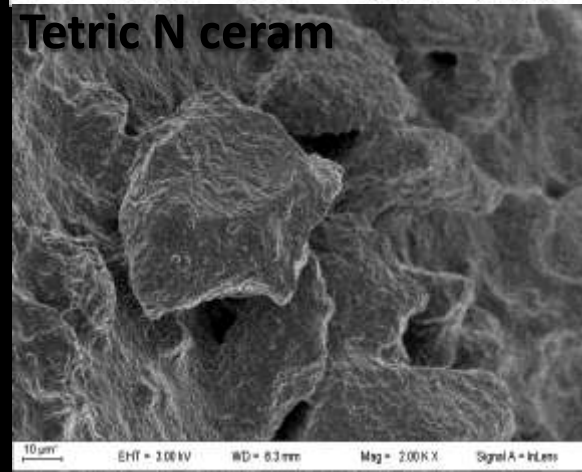
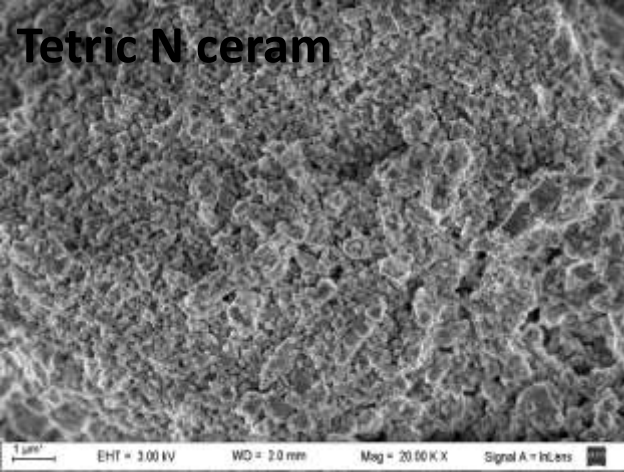
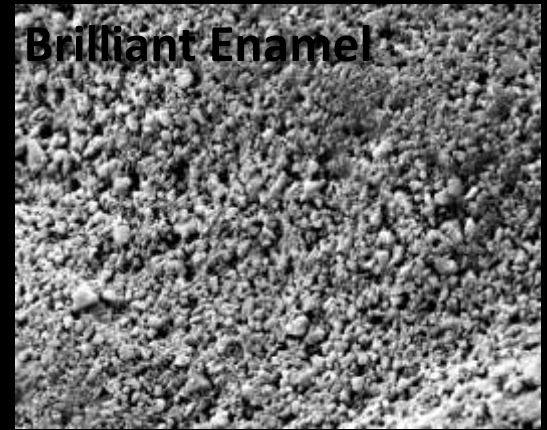
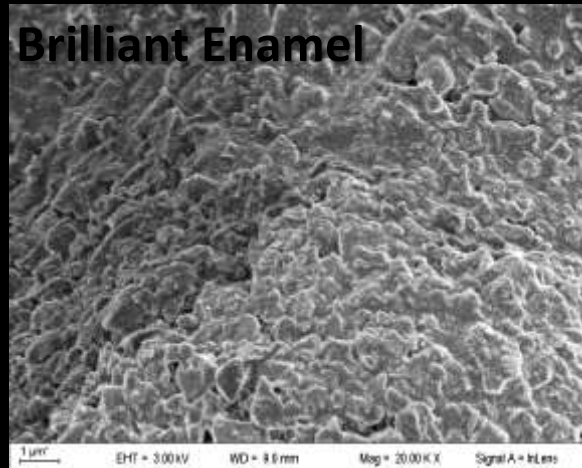
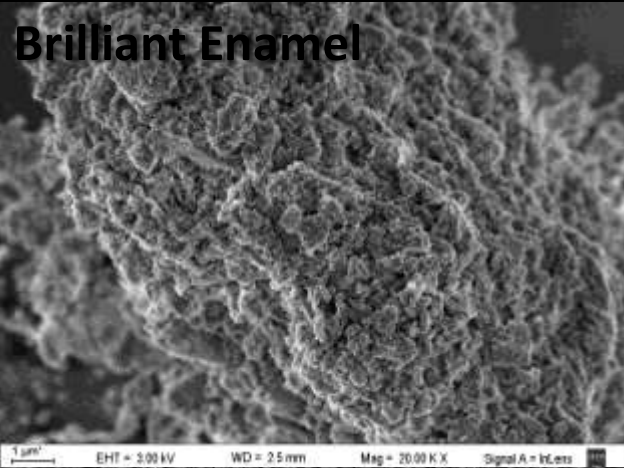


100 nm EHT = 3.00 kV WD = 1.8 mm Mag = 300 000 X Signal A = InLens

Irregular +Pre - polímero

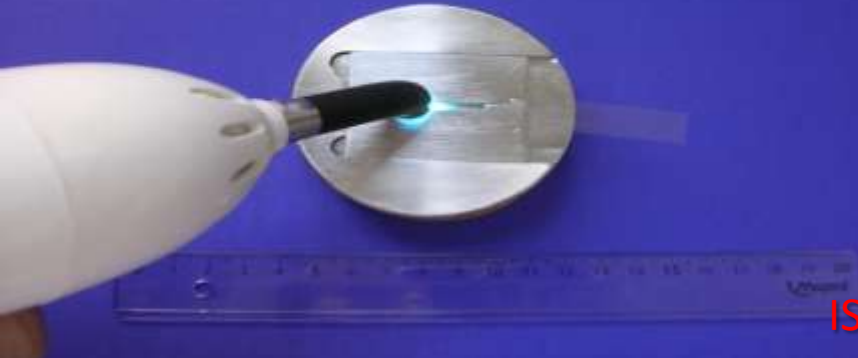


Irregular +Pre - polímero



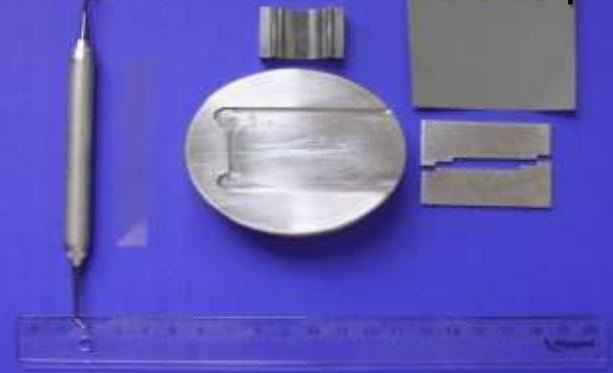
**Ensayo para determinar
las propiedades
flexurales**

Fabricación de probetas.



ISO 4049/2000

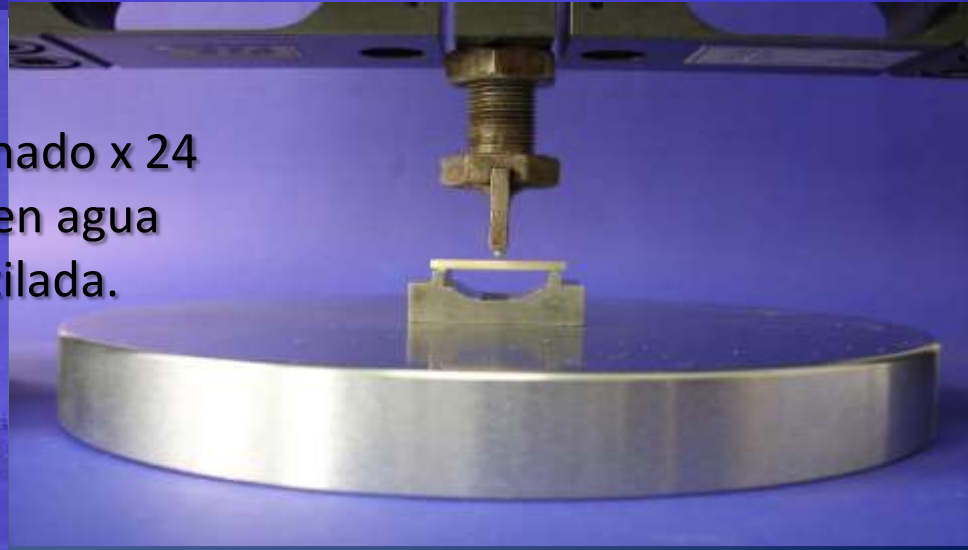
Instrumental y molde de acero inoxidable.
Prueba de flexión de tres puntos.



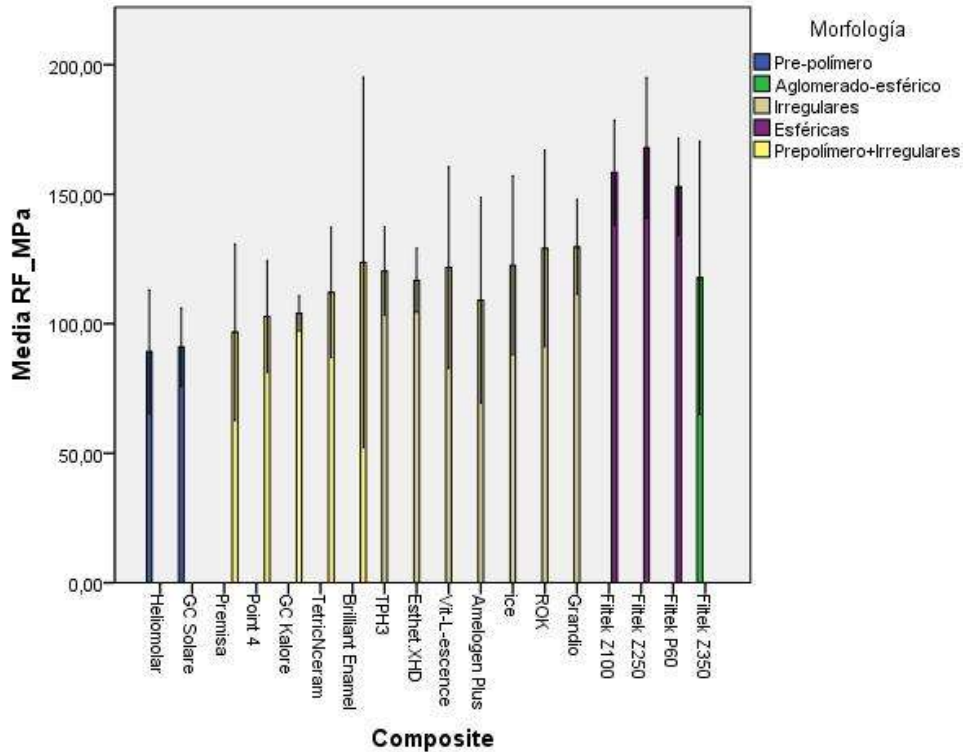
Eliminación de excesos.



Almacenado x 24
Horas en agua
Destilada.



Resistencia Flexural



Composite

Barras de error: +/- 2 DT

RF_MPa

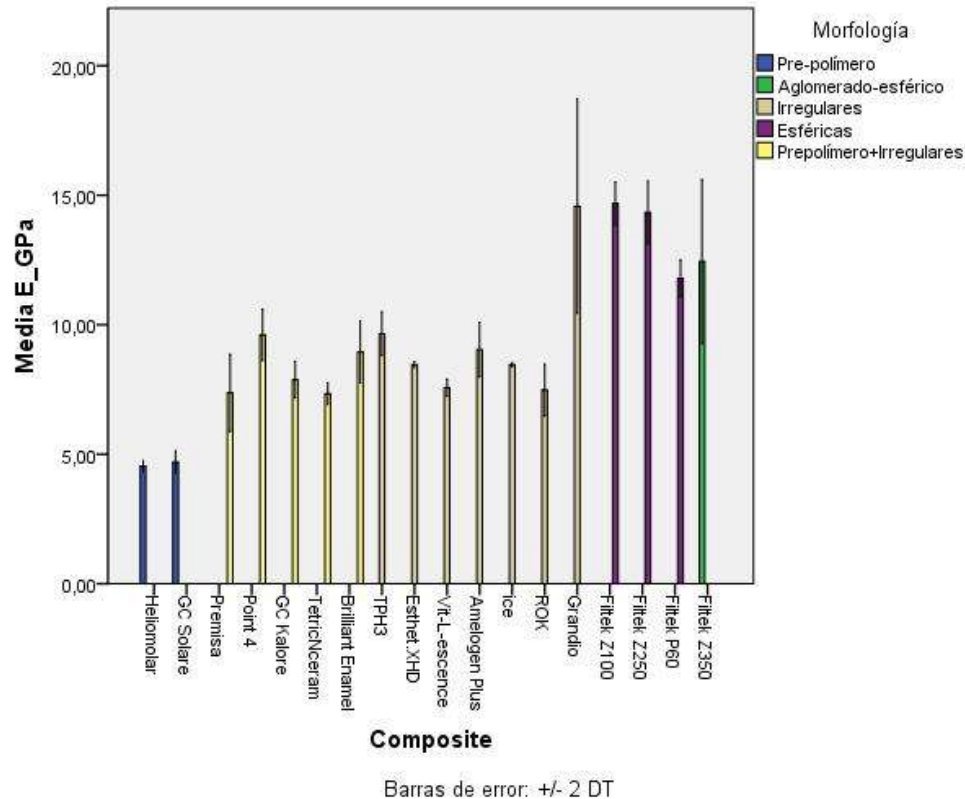
Tukey HSD^{a,b}

Morfología	N	Subset		
		1	2	3
Pre-polímero	10	90,0994		
Prepolímero+Irregulares	25	107,8471	107,8471	
Aglomerado-esférico	5		117,7686	
Irregulares	35		121,3109	
Esféricas	15			159,7403
Sig.		,086	,301	1,000

Means for groups in homogeneous subsets are displayed.
Based on observed means.
The error term is Mean Square(Error) = 274,280.

a. Uses Harmonic Mean Sample Size = 11,488.
b. Alpha = ,05.

Módulo Flexural



Tukey HSD^{a,b}

Morfología	N	Subset		
		1	2	3
Pre-polímero	10	4,6217		
Prepolímero+Irregulares	25		8,2270	
Irregulares	35		9,3170	
Aglomerado-esférico	5			12,4426
Esféricas	15			13,5973
Sig.		1,000	,084	,058

Means for groups in homogeneous subsets are displayed.
Based on observed means.
The error term is Mean Square(Error) = 1,025.

a. Uses Harmonic Mean Sample Size = 11,488.
b. Alpha = ,05.

Procedimiento para determinar el % de relleno cerámico en peso RCP.

5 porciones de composite se pesaron en balanza analítica AS200 (OHAUS®) por cada grupo



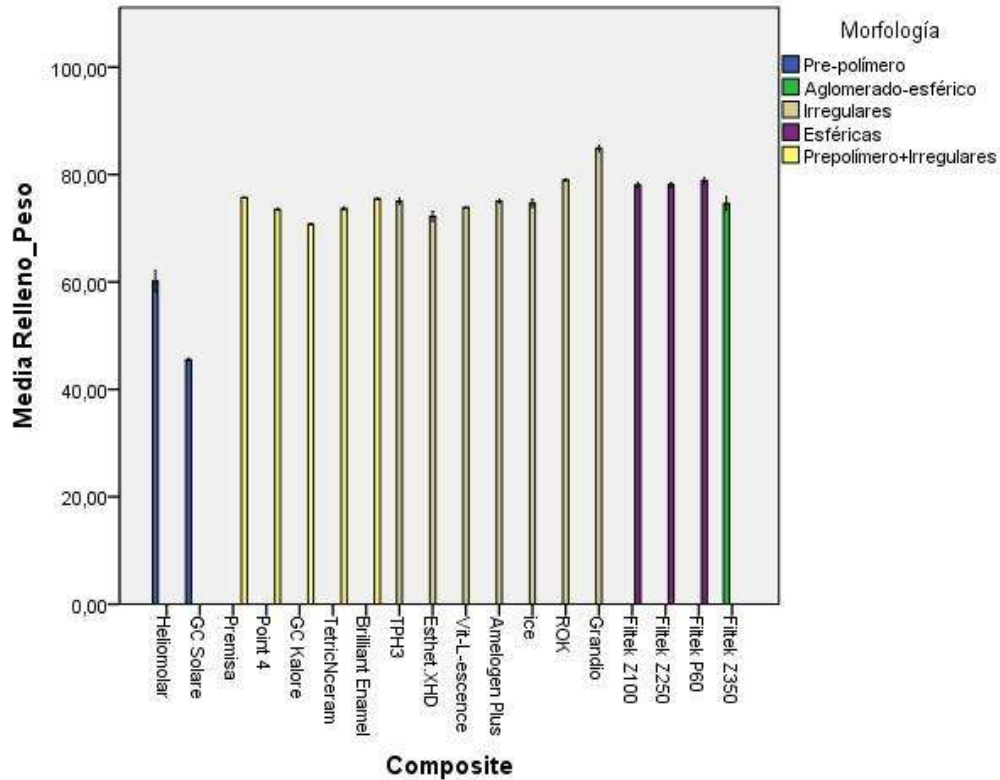
Calcinación a una temperatura de 600°C en Horno Cerámico por 40 minutos, con ciclos de apertura de la puerta del horno cada 10.



El polvo calcinado se peso nuevamente y por diferencia de masa se determino el porcentaje RCP



Relleno en Peso



Barras de error: +/- 2 DT

Relleno_Peso

Tukey HSD^{a,b}

Morfología	N	Subset		
		1	2	3
Pre-polímero	10	52,8204		
Prepolímero+Irregulares	25		73,8356	
Aglomerado-esférico	5		74,6014	
Irregulares	35		76,3816	76,3816
Esféricas	15			78,3303
Sig.		1,000	,234	,501

Means for groups in homogeneous subsets are displayed.

Based on observed means.

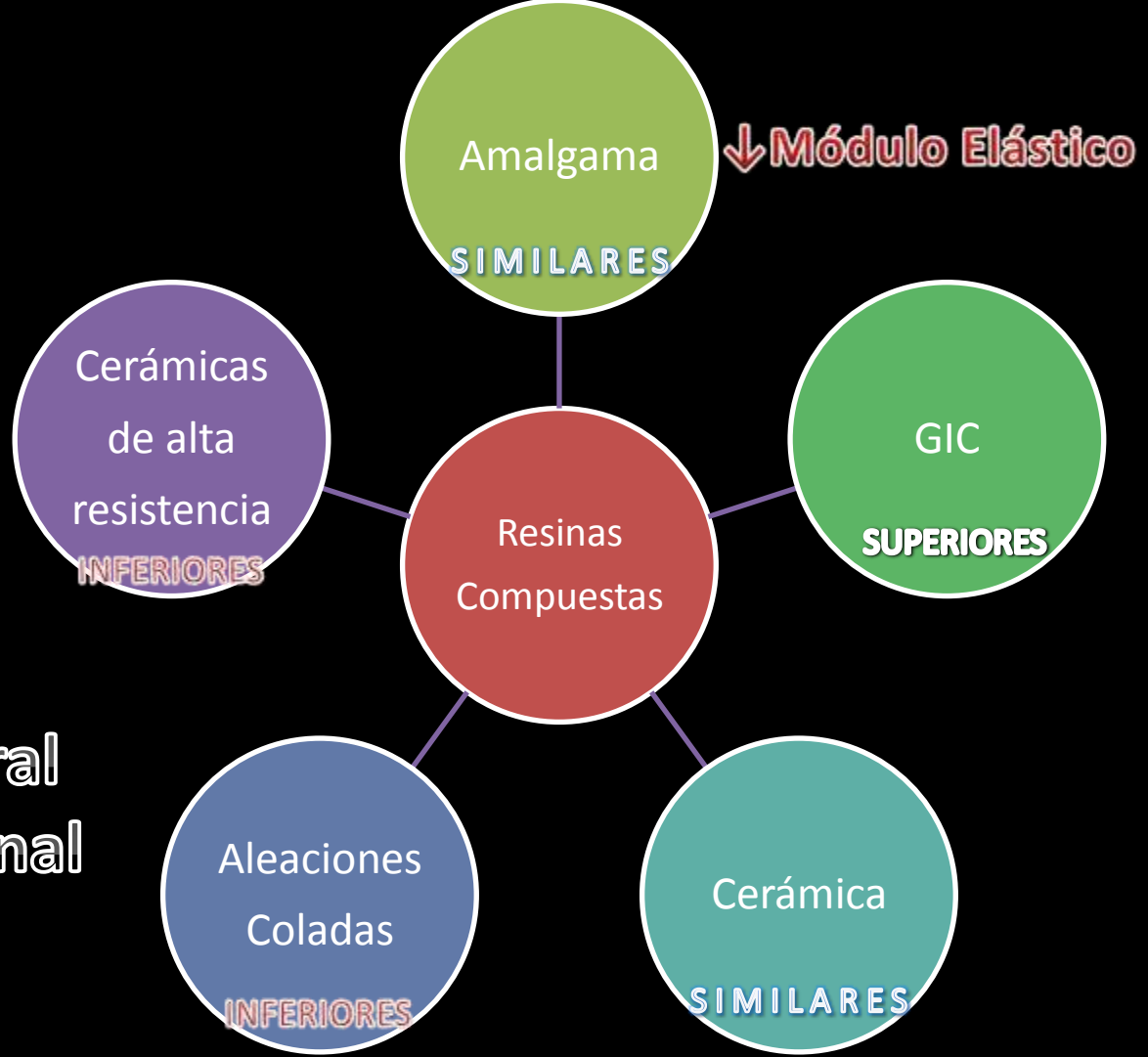
The error term is Mean Square(Error) = 8,509.

a. Uses Harmonic Mean Sample Size = 11,488.

b. Alpha = ,05.

“En general las propiedades mecánicas de las resinas compuestas se relacionan con la cantidad de relleno posible, entonces a mayor cantidad, más resistentes, rígidos y tenaces”.

Resistencia Flexural
Resistencia Tensional
Tenacidad



Implicaciones clínicas de las propiedades mecánicas:

- Las formulaciones actuales poseen adecuadas propiedades para el uso en todas las áreas de la boca, con excepción de las situaciones de alto estrés.
- El desgaste es considerado un problema menor, sin embargo hay que prestar atención en las restauraciones de gran tamaño, a las reconstrucciones por cuadrante y cuando se usa como reemplazo de cúspides.

Kramer N, Reinelt C, Richter G, Petschelt A, Frankenberger R. Nanohybrid vs. fine particle composite in class II cavities: clinical results and margin analysis after four years. *Dent Mater* 2009;25:750-9.

41. Ferracane JL. *Is the wear of dental composites still a clinical concern? Is there still a need for in vitro wear simulating devices?* *Dent Mater* 2006;22:689-92.

Relación Resistencia-Estética

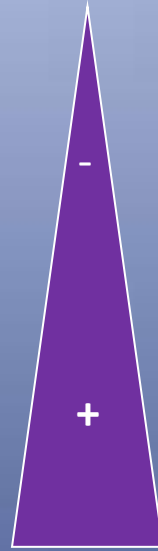
Resistencia

- híbrida
- nano-híbrida
- micro-híbrida
- nano-relleno
- micro-relleno



Estética

- esféricas
- irregulares
- irregulares + Pre – polímeros
- aglomerados esféricos
- Pre – polímeros



Estética en composites.

- Lisura superficial y la posibilidad de mantenerla en el tiempo.
- Color
- Traslucidez y opacidad



Herculite XRV Light Incisal	75.2
Z 100 Incisal	70.4
Esmalte	70.1
Filtek Supreme XT A1 Esmalte	69.1
Durafile VS A2	69.0
4 Seasons A1 Esmalte	68.2
Herculite XRV Esmalte	67.7
Point 4 A1 Body	67.5
Premise A1 Body	67.1
Esthet-X I A1 Esmalte	66.8
Z100 A2	62.1
Vit-I-escence A1	61.8
Prisma TPH A2	59.6
Herculite XRV Dentina A2	56.9
Dentina	52.6
Kolor Plus A2 Opaco	7.6

Tabla 8.1. Porcentaje de transmisión de la luz, a través de discos de resina compuesta: esmalte y dentina.



FIGURA 8.12. Discos de resinas compuestas diversas, que lucen diferentes grados de fluorescencia.

Traslucidez de resinas



EstheX



HerculiteXRD



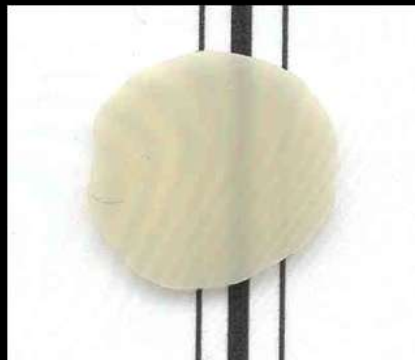
Miris Dentin



Point4



Prodigy



Vitalescence



Z100



Z250

Traslucidez de resinas



Durafill A2



Filtek A110



Heliomolar



Herculite XRE



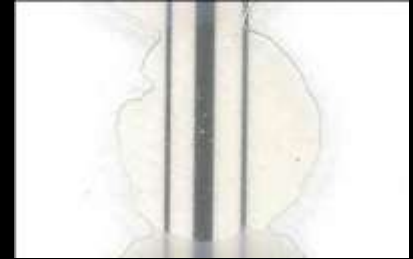
Miris Esmalte



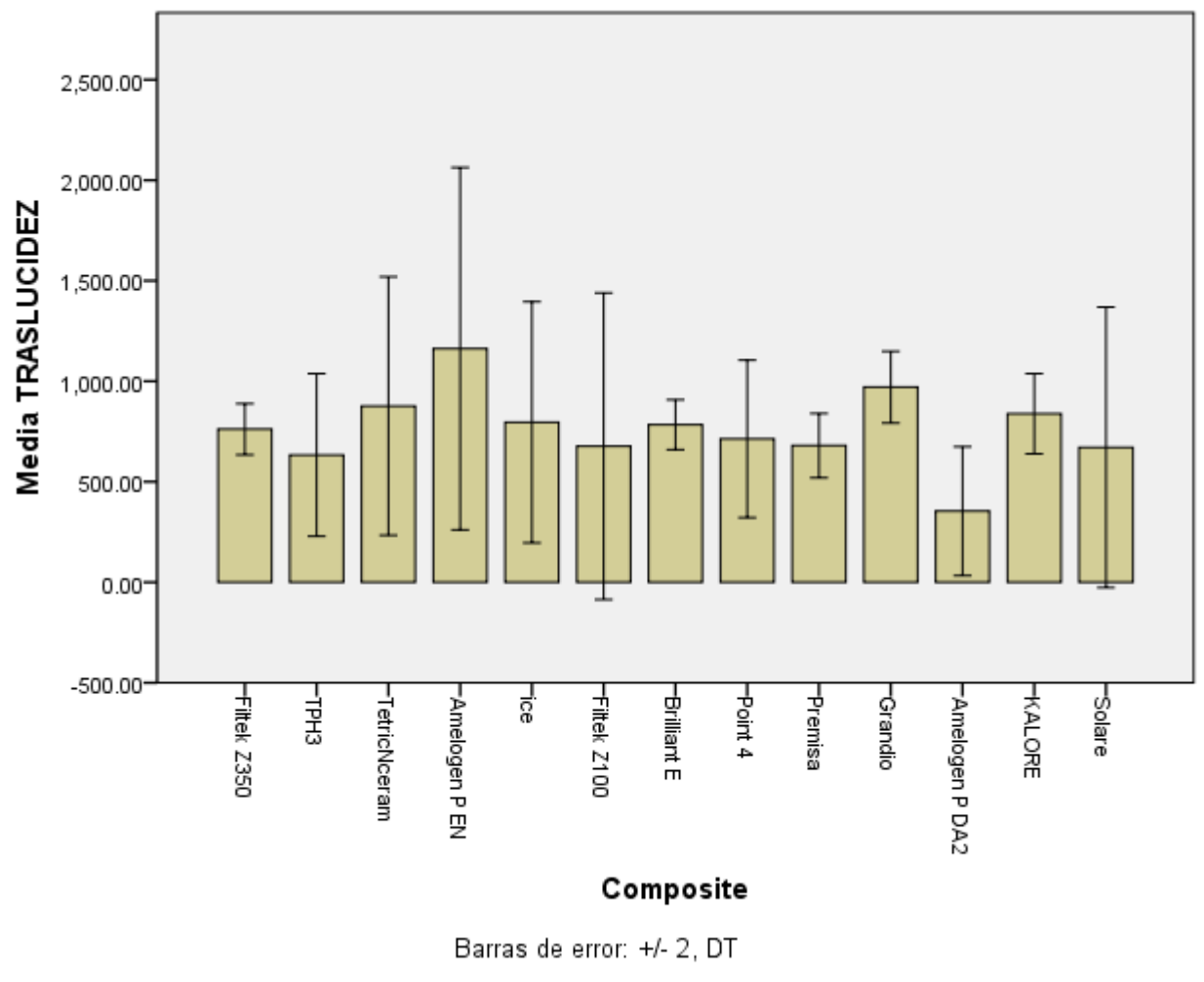
Renamel



Vitaescense Pearl F



Vitaescense TO



Acabado:

- Acabado se refiere a la adaptación de la restauración al diente y tiene como finalidad obtener buen contorno, oclusión, contactos saludables y una superficie lisa.

Pulido:

- El pulido se refiere a la eliminación de irregularidades en la superficie con el fin de dejar la superficie lo más lisa posible

Beneficios del acabado y pulido:

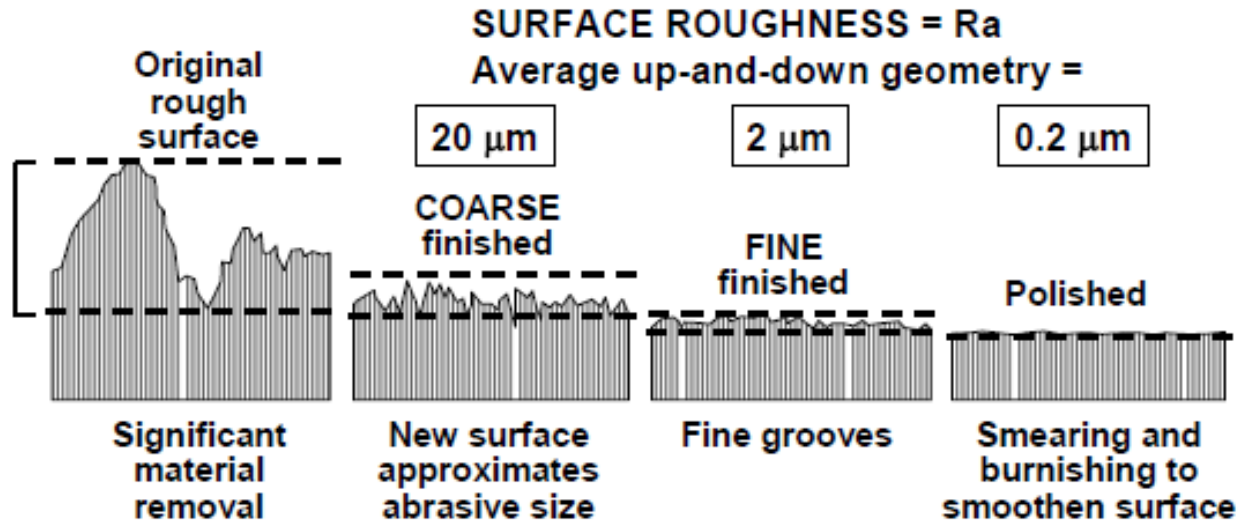
- optima lisura superficial (estética)
- salud de los tejidos gingivales
- mejora integridad marginal de la restauración en el tiempo
- aumenta el confort del paciente
- aumenta la resistencia a la pigmentación y al desgaste

Jefferies SR.: 2007

Celik C., Ozgünaltay G.: 2009

Gordan VV., Patel SB., Barrett AA., Shen C.: 2003

FINISHING AND POLISHING

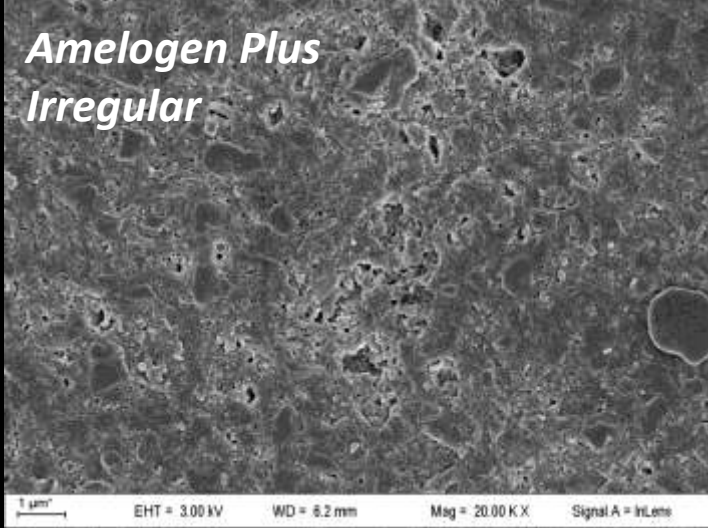


TWO CRITICAL FACTORS for Finishing and Polishing:

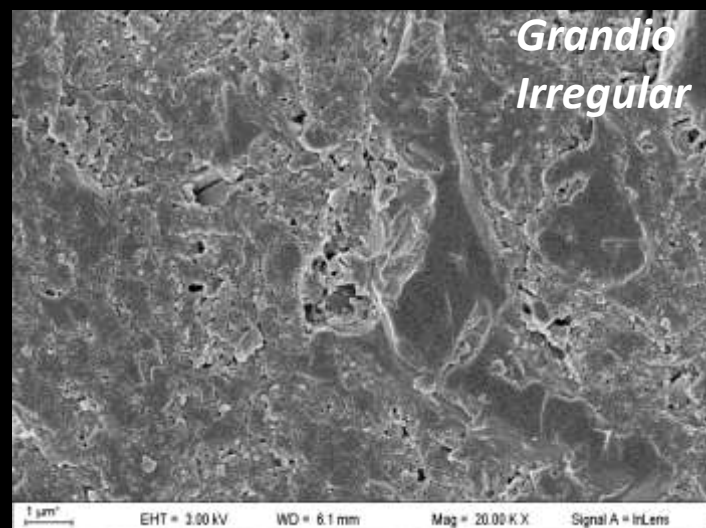
- (1) Abrasive size
- (2) Filler particle size



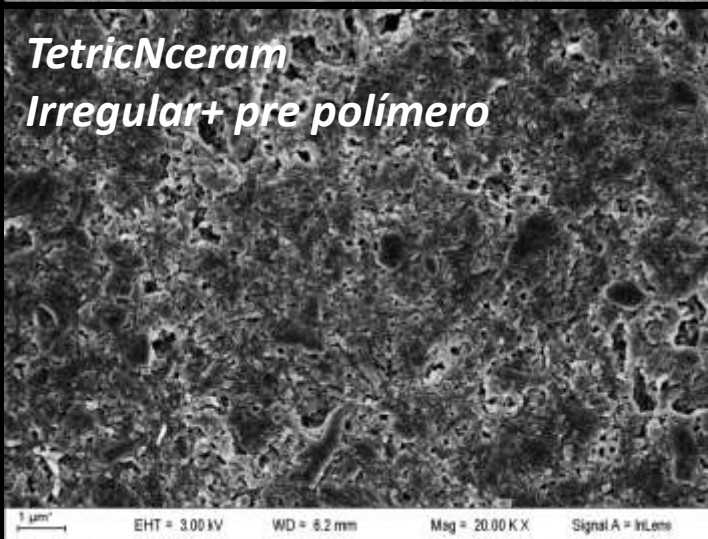
***Amelogen Plus
Irregular***



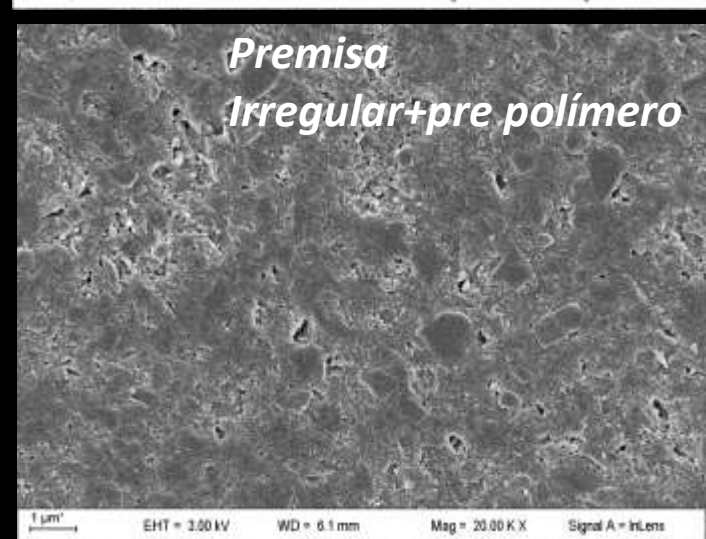
***Grandio
Irregular***



***TetricNceram
Irregular+ pre polímero***



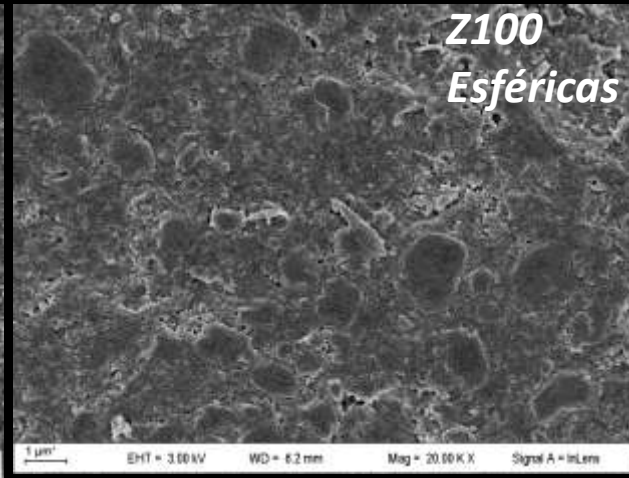
***Premisa
Irregular+pre polímero***



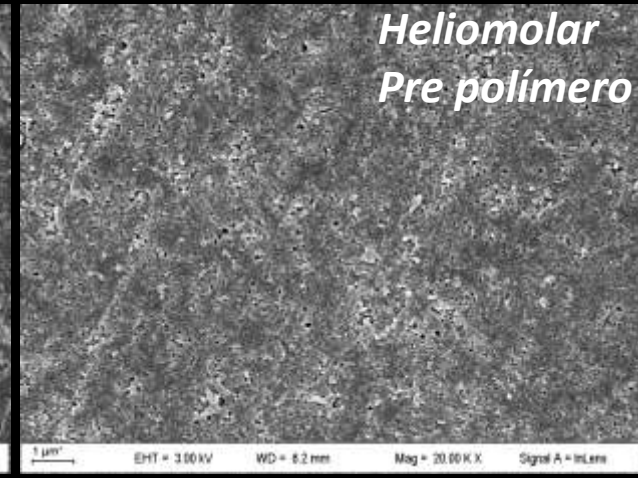
Z350
Conglomerado esférico



Z100
Esféricas



Heliomolar
Pre polímero



Group and Composite

Manufacturer

G1 Filtek™ Z350

3M/ESPE. St. Paul, MN, USA

G2 TPH®3

DENTSPLY-Caulk, Milford DE, USA

G3 Tetric® N Ceram

Ivoclar-Vivadent AG.
FL-9494
Schaan/Liechtenstein

G4 Amelogen® Plus EN

Ultradent® Products, INC.
South Jordan, UT, USA

G5 ice

SDI Limited. Victoria, AU

G6 Filtek™ Z100

3M/ESPE. St. Paul, MN, USA

G7 Brilliant Enamel

Coltène Whaledent®,
Altstätten, Switzerland

G8 Point 4™

KERR®- Sybron dental
Specialties, Orange, CA, USA

G9 Premisa™

KERR®- Sybron dental
Specialties, Orange, CA, USA

G10 Grandio®

VOCO America INC.
Sunnyside, NY, USA

G11 Amelogen® Plus D

Ultradent® Products, INC.
South Jordan, UT, USA

G12 Solare

GC America INC. Chicago, IL

G13 KALORE™

GC America INC. Chicago, IL



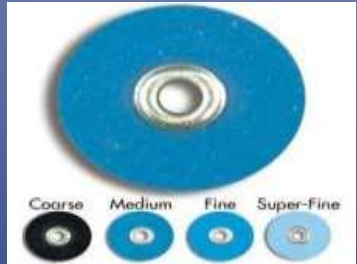
Group/ Polishing Systems	Manufacturer
--------------------------	--------------

<u>J/ Jiffy®</u>	Ultradent® Products, INC. South Jordan, UT, USA
------------------	--

<u>SS/ Super Snap®</u>	Shofu® Dental Corporation, San Marcos, CA, USA
------------------------	---

<u>AA/ Astropol/ Astrobrush.</u>	Ivoclar-Vivadent AG. FL-9494 Schaan/Liechtenstein
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<u>SL/ Sof-lex™</u>	3M/ESPE. St. Paul, MN, USA
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digital micrometer 500 (Mitutoyo Corporation, Japan)

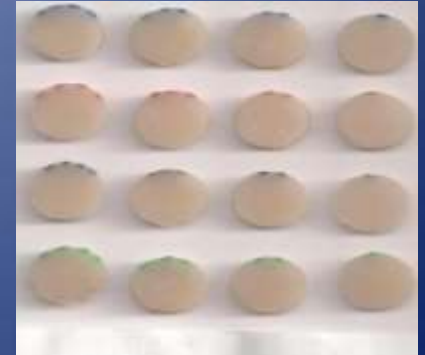
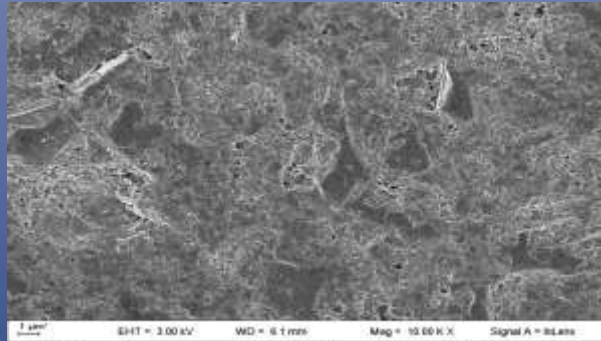
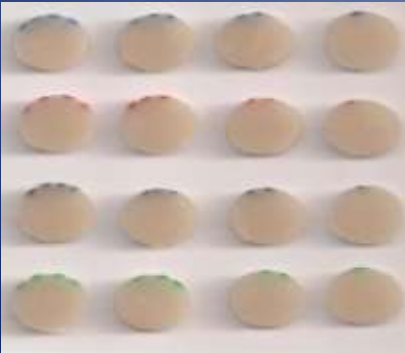


digital micrometer 500 (Mitutoyo Corporation, Japan)

Measure Pre
– Polishing

Polishing

Measure Post
- Polishing



Loss level Composite

Scheffe ^{a,b}				
	Premisa	16	,010688	
	Solare	16	,011625	
	Filtek Z100	16	,014313	,014313
	KALORE	16	,018063	,018063
	Filtek Z350	16	,018438	,018438
	Amelogen P DA2	16	,018625	,018625
	Point 4	16	,019813	,019813
	Grandio	16	,021250	,021250
	Brilliant E	16	,022188	,022188
	TetricNceram	16	,026375	,026375
	Amelogen P EN	16	,030000	,030000
	TPH3	16		,033625
	ice	16		,035813
	Sig.		,152	,054

Means for groups in homogeneous subsets are displayed.

Based on observed means.

The error term is Mean Square(Error) = ,000.

a. Uses Harmonic Mean Sample Size = 16,000.

b. Alpha = ,05.

Loss level polish system

Scheffe ^{a,b}	Sof-Lex	52	,009981	
	Jiffy	52		,023404
	Super Snap	52		,025942
	Astropol	52		,027077
	Sig.		1,000	

Means for groups in homogeneous subsets are displayed.

Based on observed means.

The error term is Mean Square(Error) = ,000.

a. Uses Harmonic Mean Sample Size = 52,000.

b. Alpha = ,05.

Expectativas para el futuro.

- Matrices que no contraigan.
- Material inteligente, que dependiendo del pH libera más ó menos fluoruro.
- Resinas compuestas restauradoras de uso universal auto-adhesivas, basadas en monómeros auto-adhesivos.

Se recomienda que las resinas compuestas desarrollen propiedades antibacterianas, mejoren la capacidad de sellado dentina y disminuyan la contracción de polimerización

Sarrett DC.

Dent Mater. 2005 Jan;21(1):9-20.



Gracias por su atención



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