

HYBRID COMPOSITES

- ✓ Latest category of composite material .
- ✓ Developed to obtain better surface smoothness than the Small particles , yet maintaining the properties .
- ✓ Have surface smoothness & esthetics competitive with Microfilled composites for anterior restorations.

Hybrid composites

John Summerscales

Hybrid: definition

- incorporation of two or more fibres within a single matrix
- the resulting material is a **hybrid composite**, often abbreviated to just "hybrid".
- or it may be two resin systems e.g. an interpenetrating network

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Hybrid Composites

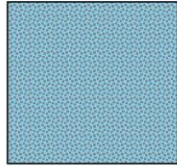
- Hybrid Composites
 - Relatively new fiber reinforcement composites
 - Two or more different kind of fibers in a single matrix
 - Better combination of properties
 - Carbon and glass fibers in a polymeric resin
 - Carbon fibers strong , relatively stiff, low density but expensive
 - Glass fibers inexpensive but lack stiffness
 - Carbon-glass hybrid – stronger & tougher, high impact resistance at lower cost than either all carbon or all glass
 - Different ways to combine fibers that affect properties (mostly anisotropic)
 - Hybrid composite in tension non catastrophic failure
 - Light weight land, water & air transport structural components, sporting goods, light weight orthopedic components



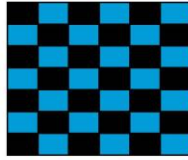
Hybrid Composites

Incorporation of two or more fibres within a single matrix resulted in formation of **hybrid composite**.

Hybrids: configuration



a



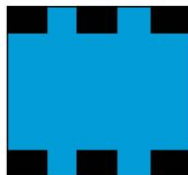
b



c



d



e



f

HYBRID COMPOSITES

Hybrid materials are composites consisting of two constituents at the nanometer or molecular level. Commonly one of these compounds is inorganic and the other one organic in nature. Thus, they differ from traditional composites where the constituents are at the macroscopic (micrometer to millimeter) level. Mixing at the microscopic scale leads to a more homogeneous material that either show characteristics in between the two original phases or even new properties.

Classification:

Hybrid materials can be classified based on the possible interactions connecting the inorganic and organic species.

Class I hybrid materials are those that show weak interactions between the two phases, such as van der Waals, hydrogen bonding or weak electrostatic interactions.

Class II hybrid materials are those that show strong chemical interactions between the components such as covalent bonds.

ADVANTAGES OF HYBRID MATERIALS OVER TRADITIONAL COMPOSITES

- Inorganic clusters or nanoparticles with specific optical, electronic or magnetic properties can be incorporated in organic polymer matrices.
- Contrary to pure solid state inorganic materials that often require a high temperature treatment for their processing, hybrid materials show a more polymer-like handling, either because of their large organic content or because of the formation of crosslinked inorganic networks from small molecular precursors just like in polymerization reactions.



Applications of HYBRID COMPOSITES

- Scratch-resistant coatings with hydrophobic or anti-fogging properties.
- Nanocomposite based devices for electronic and optoelectronic applications including [light-emitting diodes](#), [photodiodes](#), [solar cells](#), [gas sensors](#) and [field effect transistors](#).
- Fire retardant materials for construction industry.
- Nanocomposite based [dental filling](#) materials.
- Composite [electrolyte](#) materials for applications such as solid-state lithium batteries or [supercapacitors](#).
- [Corrosion](#) protection



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Composite resin ?? Hybrid or micro-fill??

Microfill composite is used in class III, V, diastema closure, facial enamel, because of the high polishability

* **The use of microfill composite in cervical areas allows:**

- optimal soft tissue response due to the high polishability
- their lower stiffness, compared to hybrid composite help in resisting displacement during tooth flexure