



Óbuda University

Doctoral School of Materials  
Science and Technologies

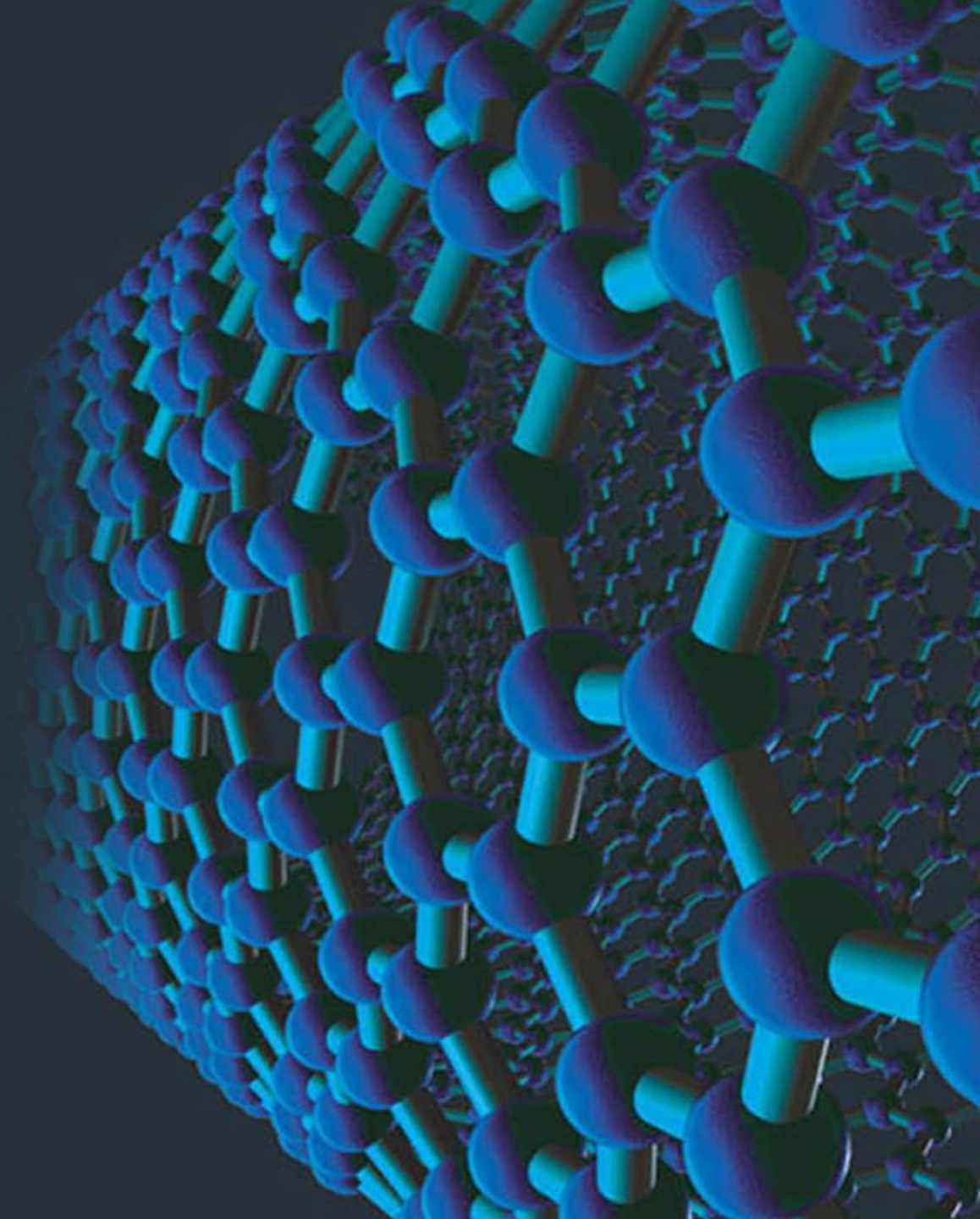
# Preparation and Investigation of Nanocomposites with Polymer Matrix

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# Polymer nanocomposites

Polymer



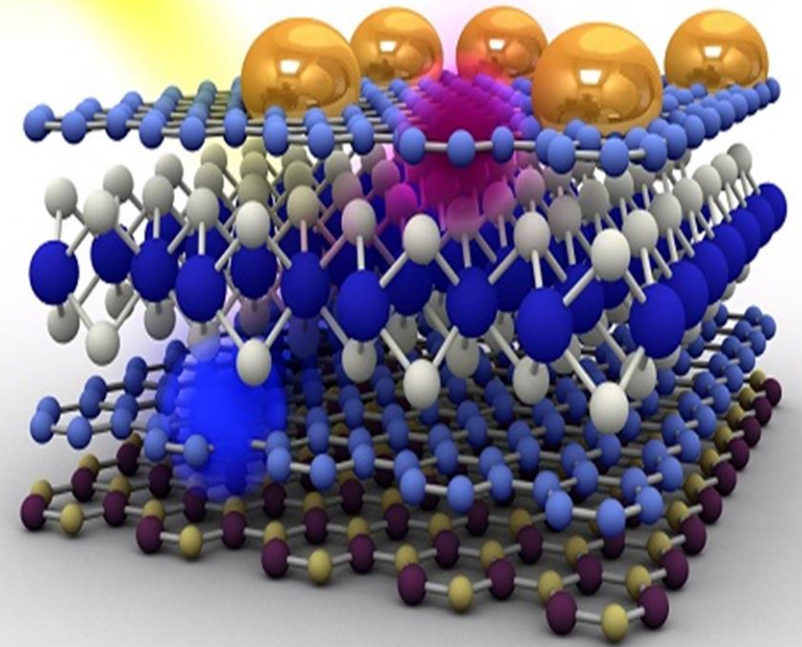
Monomers

Polymerization



Polymer

Nanocomposite



## Types of nanocomposites:

**Non-polymer  
nanocomposites**

**Polymer  
nanocomposites**

Metal nanocomposites

Ceramic  
nanocomposites

Ceramic-ceramic  
nanocomposites

They use in the  
dentist fields



## Types of nanocomposites:

**Non-polymer  
nanocomposites**

**Polymer  
nanocomposites**

Nanocomposite allow polymers to be reinforced at the molecules

Increased electrical conductivity.

Increased mechanical properties.

Increased chemical resistance.

Increased thermal stability.

Increased recyclability.

Hinders flame and reduce smoke generations.

Low permeability of gases and water.

## Types of nanocomposites:

**Non-polymer  
nanocomposites**

**Polymer  
nanocomposites**

The effect of filler is depending on several factors, such as

→ Properties of the polymer matrix.

→ Nature and type of nanofiller.

→ Concentration of filler.

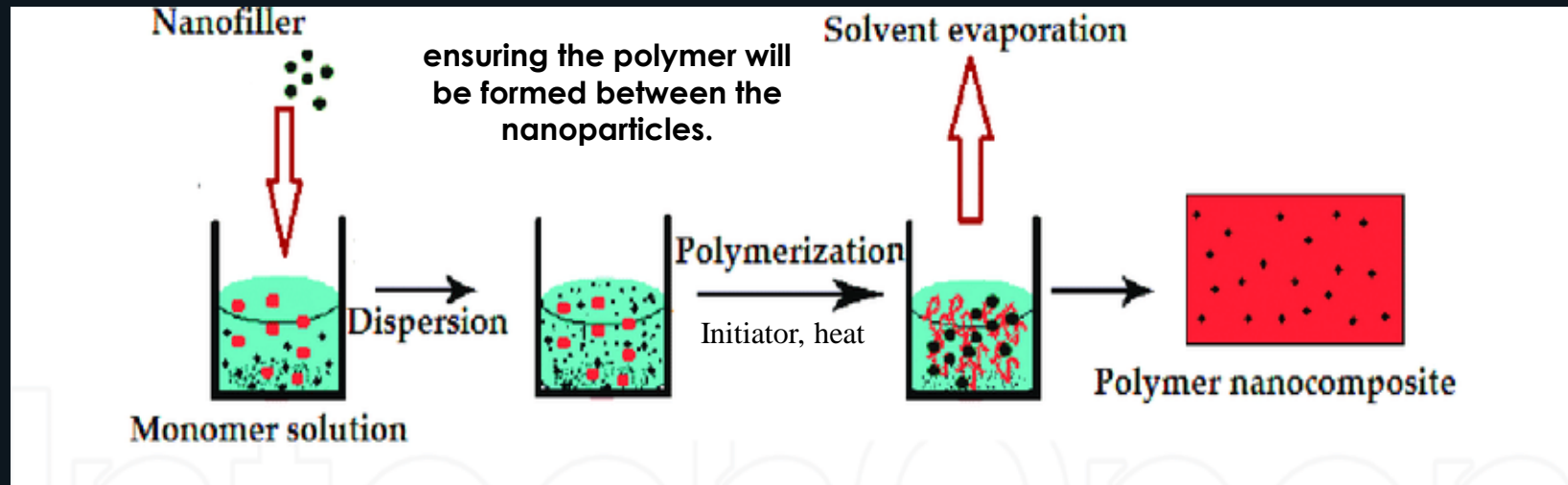
## Processing of polymer nanocomposites:

A suitable method is selected according to the type of polymeric matrix, nanofiller and required properties for the final products.

### In situ polymerization

The nanofiller must be properly dispersed in the monomer solution before the polymerization process starts.

Polymerization can be started when added suitable initiator and it is exposed to suitable source of heat, light, etc



## Processing of polymer nanocomposites:

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In situ polymerization

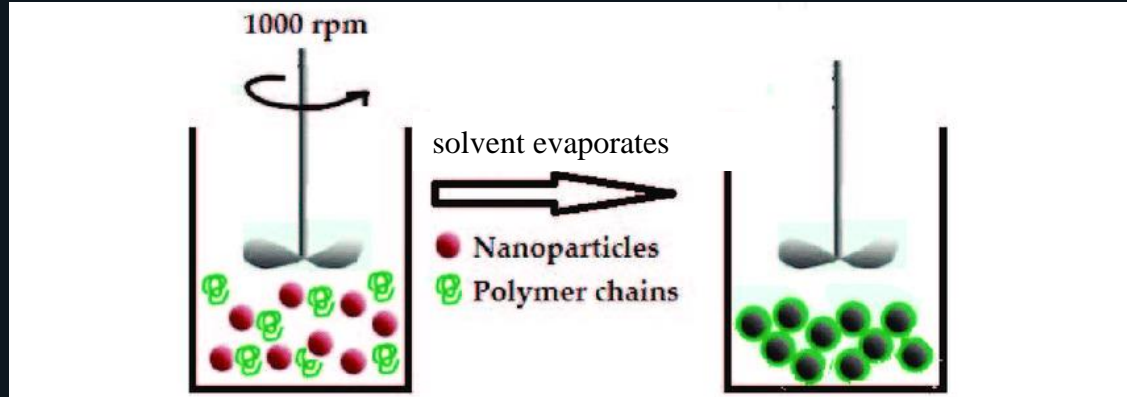
Blending

Solution blending

Melt blending

It is including the polymer and nanofiller, which are easily dispersed in a suitable solvent.

When the solvent evaporates, the nanoparticle remains dispersed into the polymer chains.



## Processing of polymer nanocomposites:

A suitable method is selected according to the type of polymeric matrix, nanofiller and required properties for the final products.

In situ polymerization

Blending

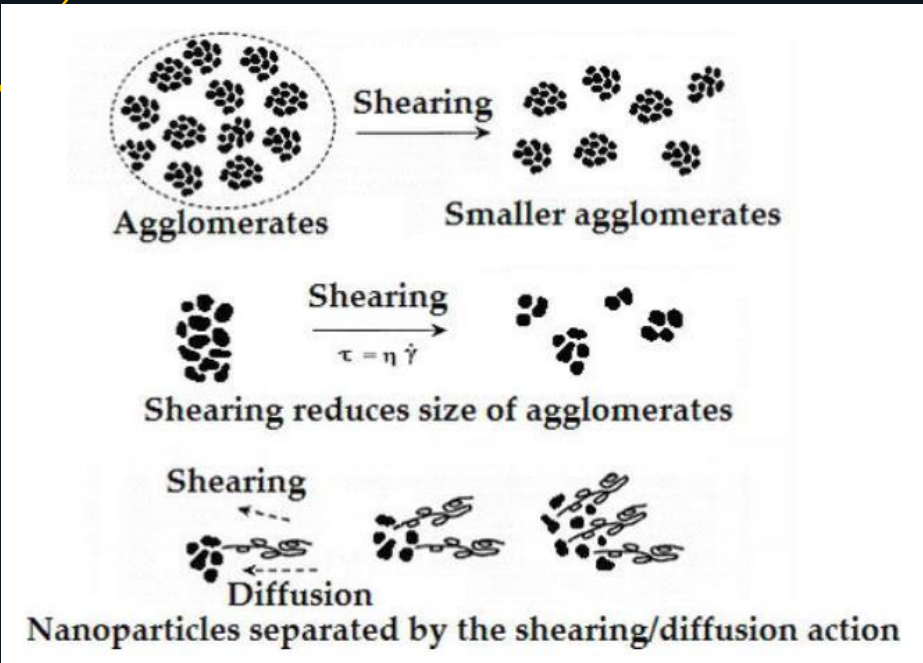
Solution blending

Melt blending

The nanofillers are directly dispersed into the molten polymer.

Large agglomerates break down and form smaller ones dispersed through the polymer matrix.

The transfer of strain from the polymer to these new agglomerates leads to stronger shearing, which breaks them into single particles.





## Processing of polymer nanocomposites:

Method	advantages	disadvantages
In situ polymerization	Controllable particle morphology. High transparency. Good interfacial adhesion of the nanofillers.	Costly . Time consuming.
Solution Blending	Reduce the permeability of gases. Easy operation. General technique for all types of nanofillers.	Aggregation. Environmental limitation.
Melt blending	Good dispersion of the nanoparticles. Enhancement of the heat stability. Improvement of mechanical properties.	Use of high temperatures, thus damage the modified surface of the nanofillers

# Uses of polymer nanocomposites:

Battery manufacturing



EM radiation absorption



electronics and automobile

solar cells



Coating



Information industry

Transportation & safety

Environmental treatment



Food packaging

Protection system

New catalysts

Energy storage & saving

Transistors



## Research problem

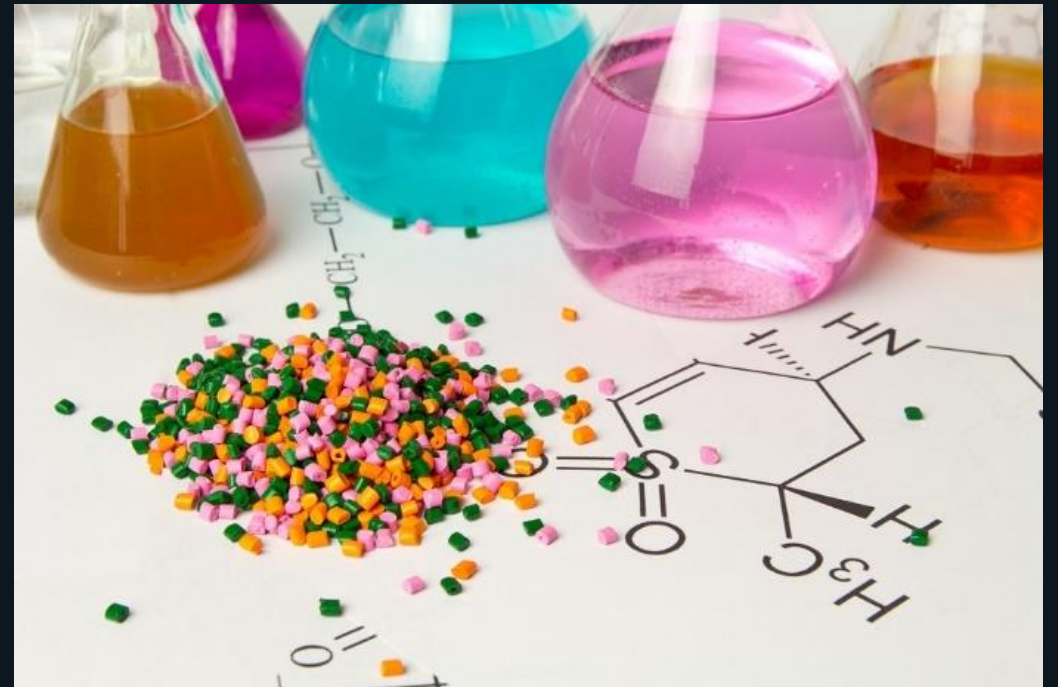
Improving the properties of nanocomposites by searching for polymeric materials available

Reduce repair costs.

Increase the investment life of these materials.

## Aim of the research

Study possibility of modification some properties of polymer nanocomposites.



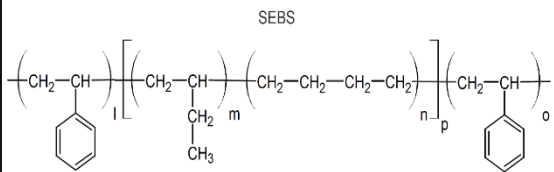
## Work Plan (Research Methodology)

The research includes a series of the experimental steps as following

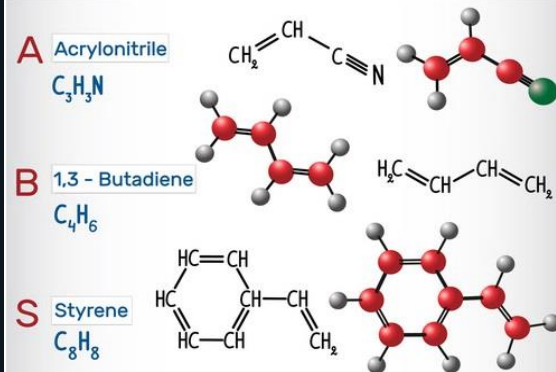
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Preparation of polymer nanocomposites in different rate

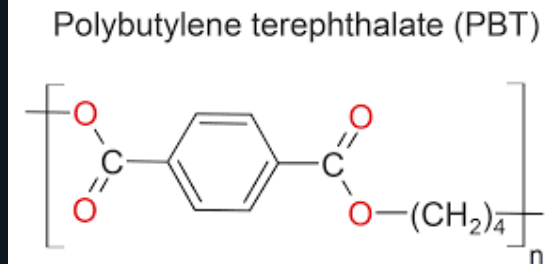
Styrene-ethylene-butylene-styrene (SEBS)



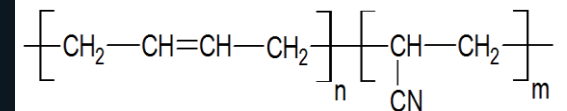
Acrylonitrile butadiene styrene (ABS)



Polybutylene terephthalate (PBT)



Nitrile rubber (NBR)





## Work Plan (Research Methodology)

The research includes a series of the experimental steps as following

1

Preparation of polymer nanocomposites in different rate

2

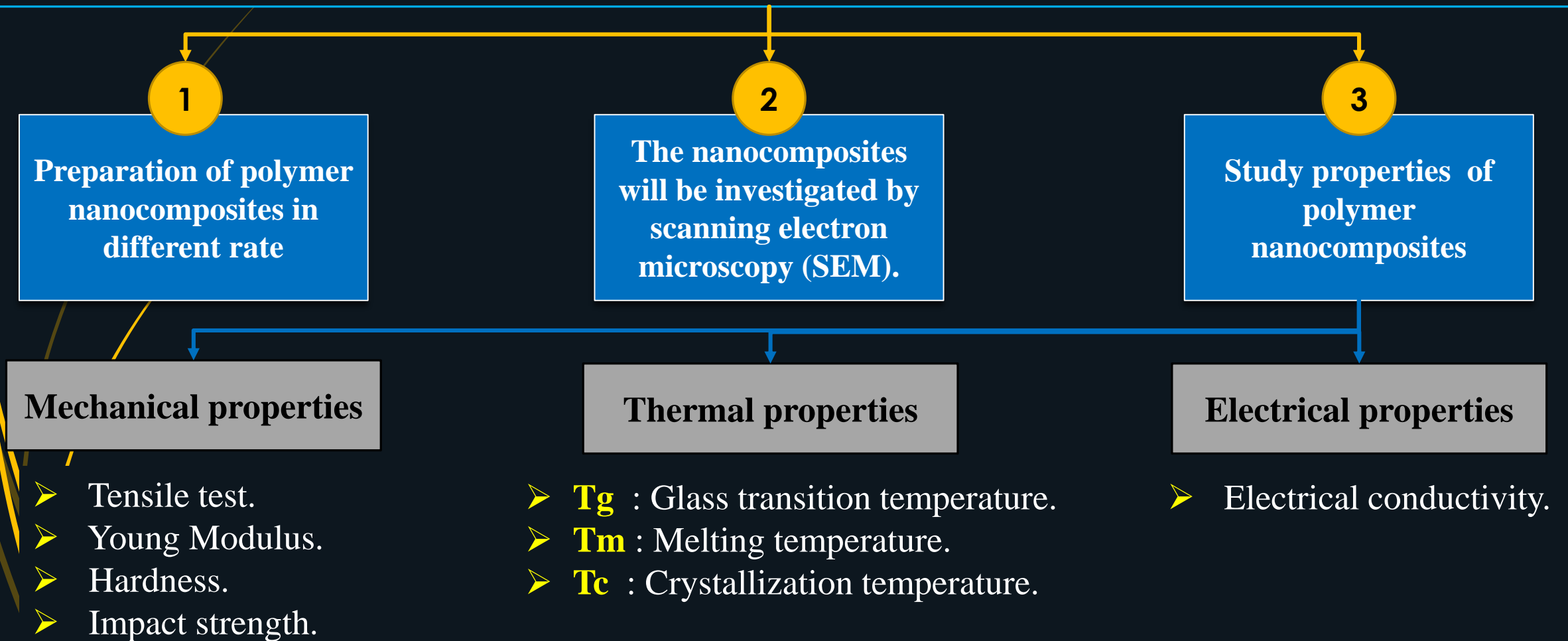
The nanocomposites will be investigated by scanning electron microscopy (SEM).





## Work Plan (Research Methodology)

The research includes a series of the experimental steps as following



Thank you for  
your attention

