



Óbuda University
Doctoral School of Materials
Science and Technologies

Preparation and Investigation of Nanocomposites with Polymer Matrix

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Summary of literature review

1

- Many modern technologies and industries need materials that have unusual properties that cannot be found in traditional materials.

2

- Composite materials are important because they have properties that are suitable for many industrial applications.

3

- The addition of nanomaterials to the polymer matrix → Improvement of the properties of the polymer.

4

- Most nanofillers used for polymer composites are multi-walled carbon nanotubes.

5

- So, we must achieve a homogeneous dispersion of MWCNTs within the polymer matrix .



The
problem
to be
solved

Improving the properties of nanocomposites by adding
MWCNTs

Reduce amount of MWCNTs

Increase the investment life
of these materials



Aim of the
research



Study the effect of the addition of multiwall carbon
nanotubes (MWCNTs) on the properties of polymer.



Practical part

Materials

Polybutylene Terephthalate (PBT)

Low humidity absorption

High strength and hardness

Resistance

High temperature

Good wear

electricity

flame

motor oil, gasoline and brake fluids.

Multi wall carbon nanotubes (MWCNTs)

Huge surface area to volume ratio

Mechanical and thermal strength

Increased ductility with no decrease of strength

Friction and wear resistance.

It is 100 times stronger than steel

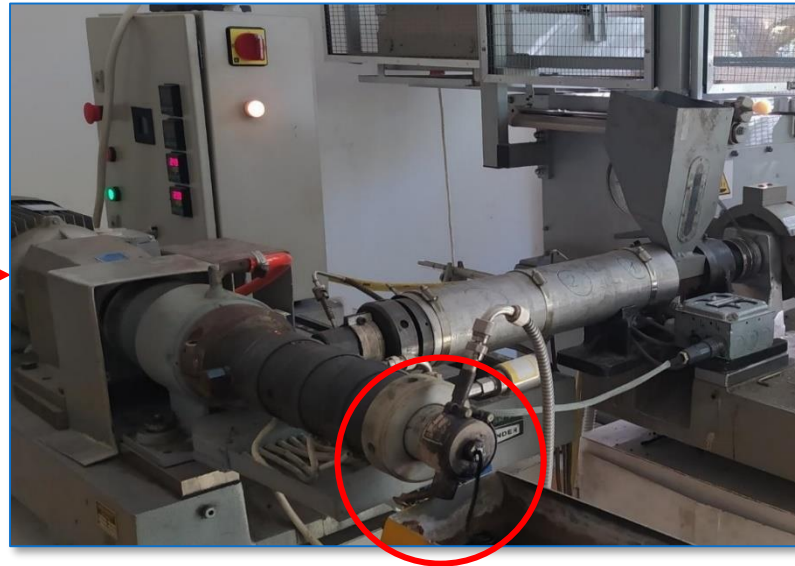


Practical part

1- We added MWCNTs to dried PBT with the following ratios 0.2, 0.4, 0.6, 0.8, 1, 1.2 %wt.

2- We prepared the test samples by putting granular mix (PBT/MWCNT) into the extrusion machine which connected to the mixer at a temperature of 250 °C.

3- We scanned them by using a (DSC) during the following cooling rates 2, 5, 10, 20 °C/ min to determine the crystallization kinetics of the material in non-isothermal conditions.





Practical part

Differential Scanning Calorimetry (DSC):

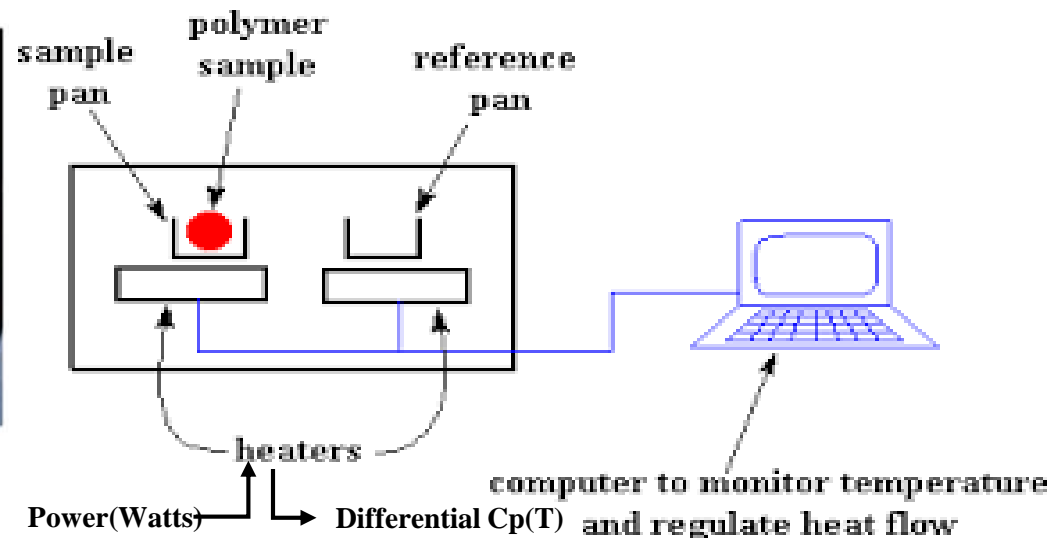
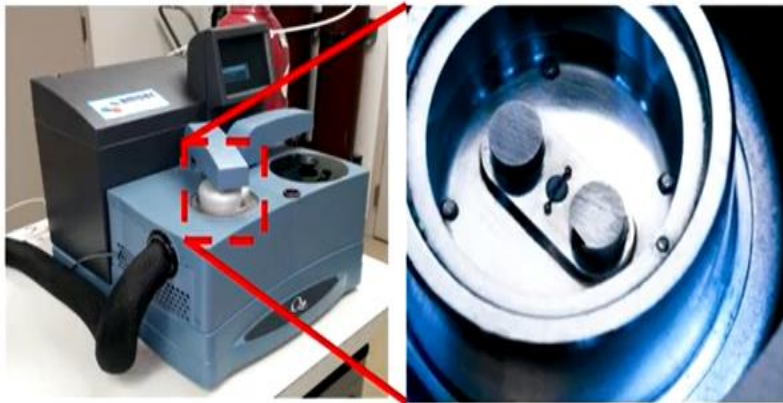
How does DSC work?

- The DSC consists of a measurement chamber and a computer.

The **sample pan** contains the material being investigated .

The **second pan**, also known as the reference pan, is empty.

- The sample and reference are heated at the same rate from a single heating source.
- The temperature difference between the pans is recorded and converted to a power difference.
- This power difference gives the difference in heat flow.

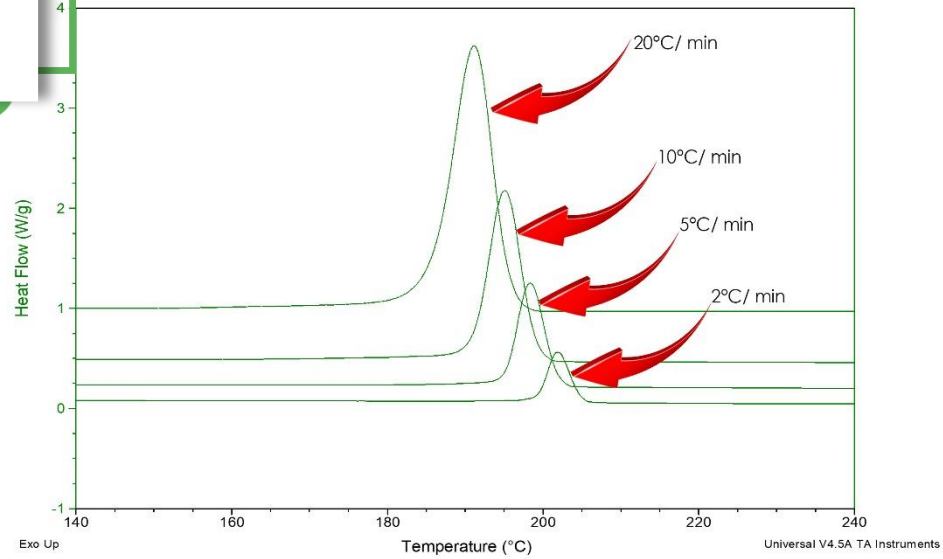




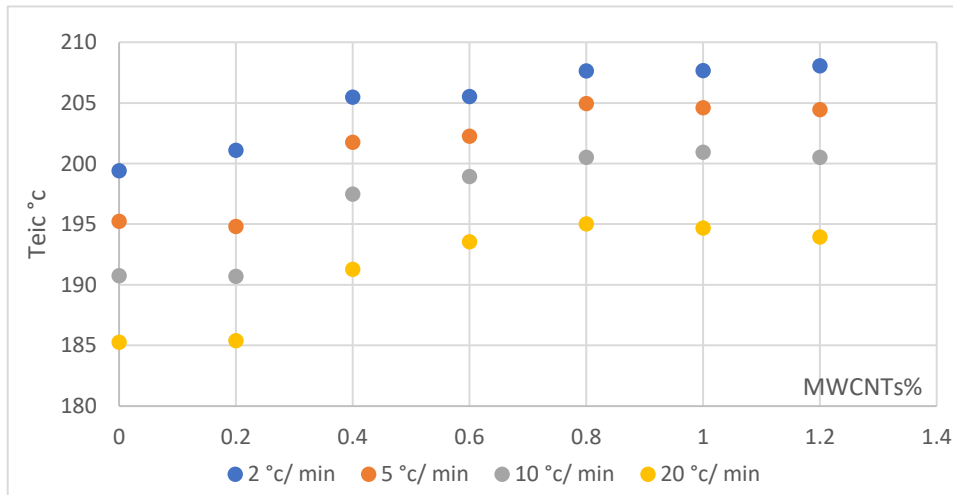
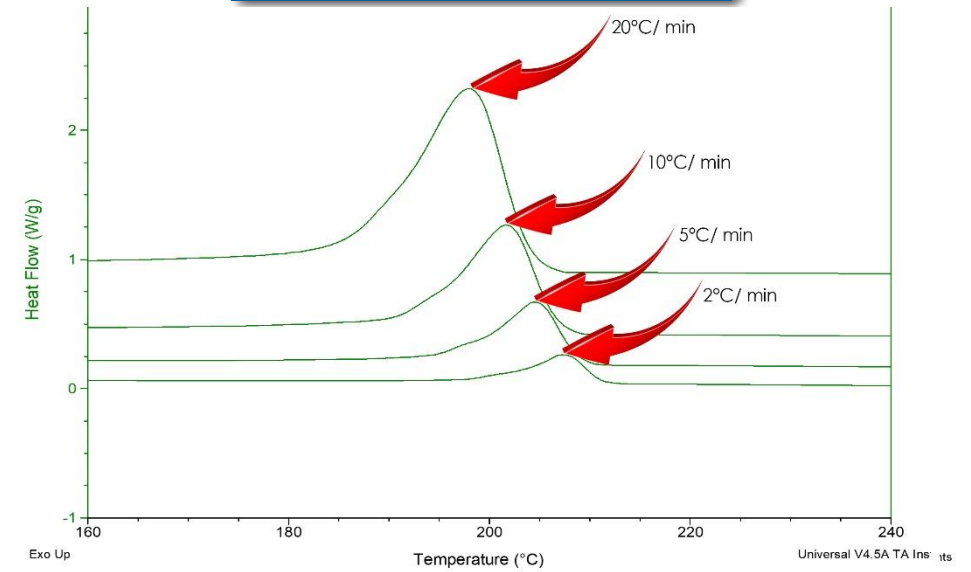
The results

Crystallization

PBT+0 % MWCNTs



PBT+0.2 % MWCNTs

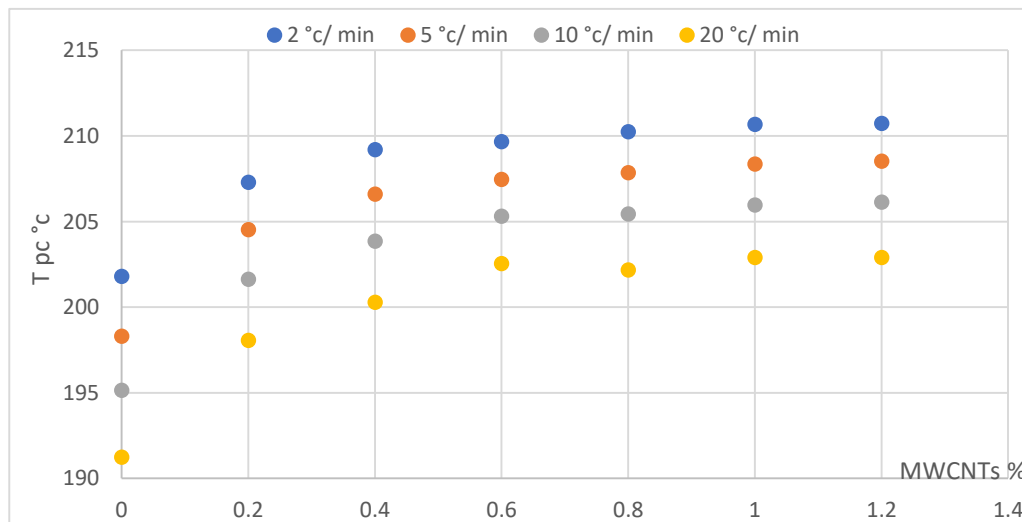
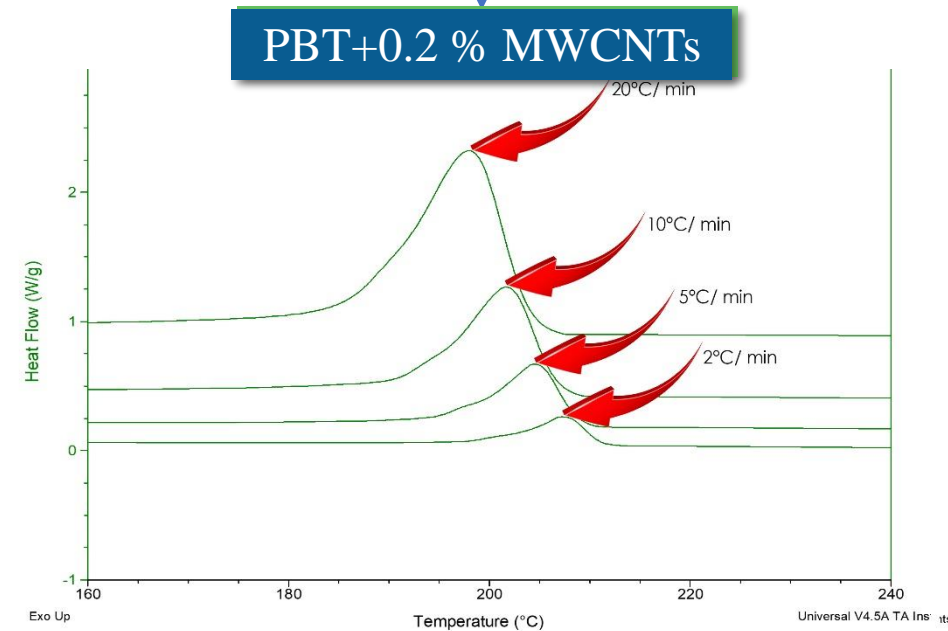
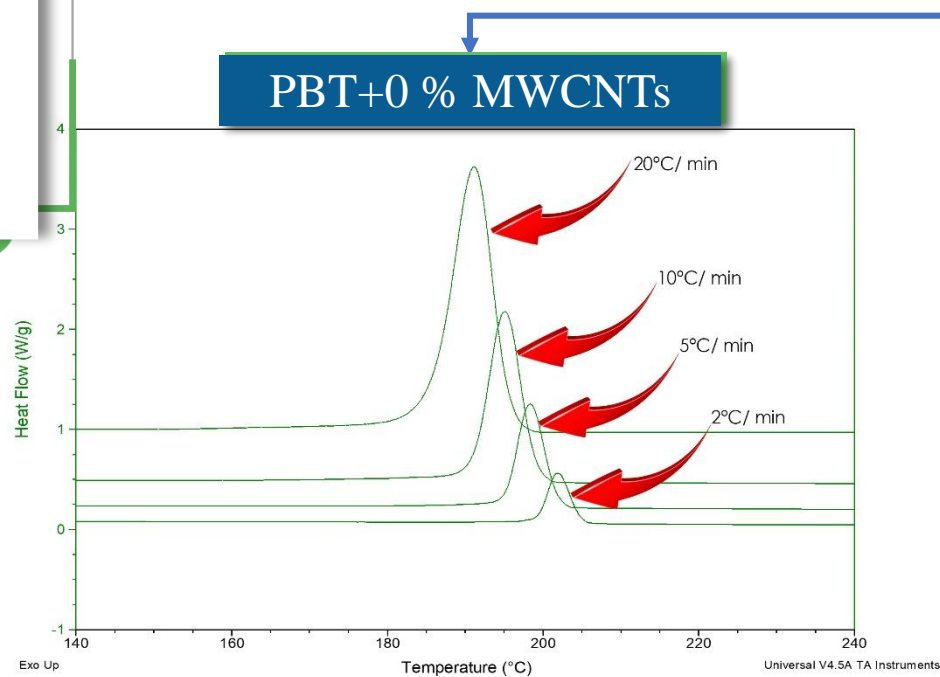


Effect of cooling rates and content of MWCNTs on the initial extrapolated temperature of crystallization



The results

Crystallization

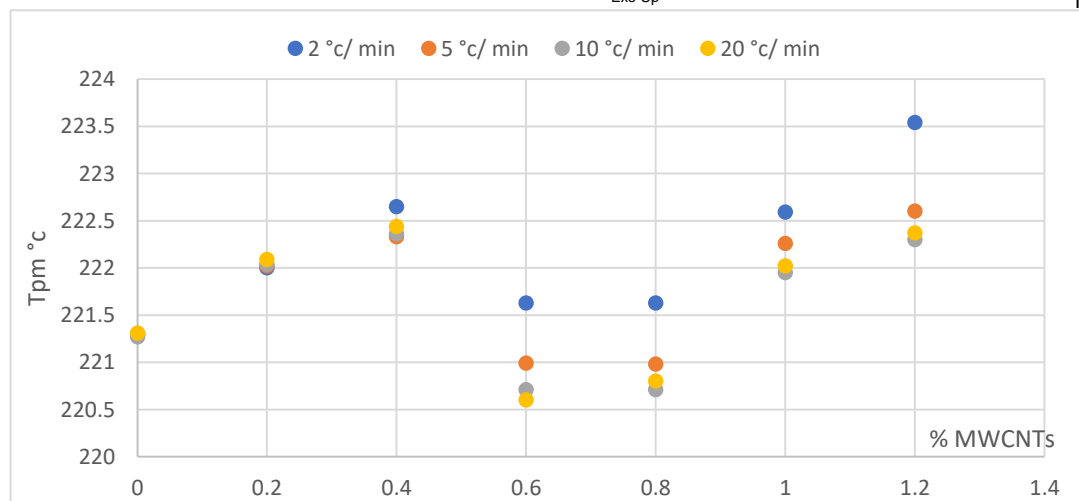
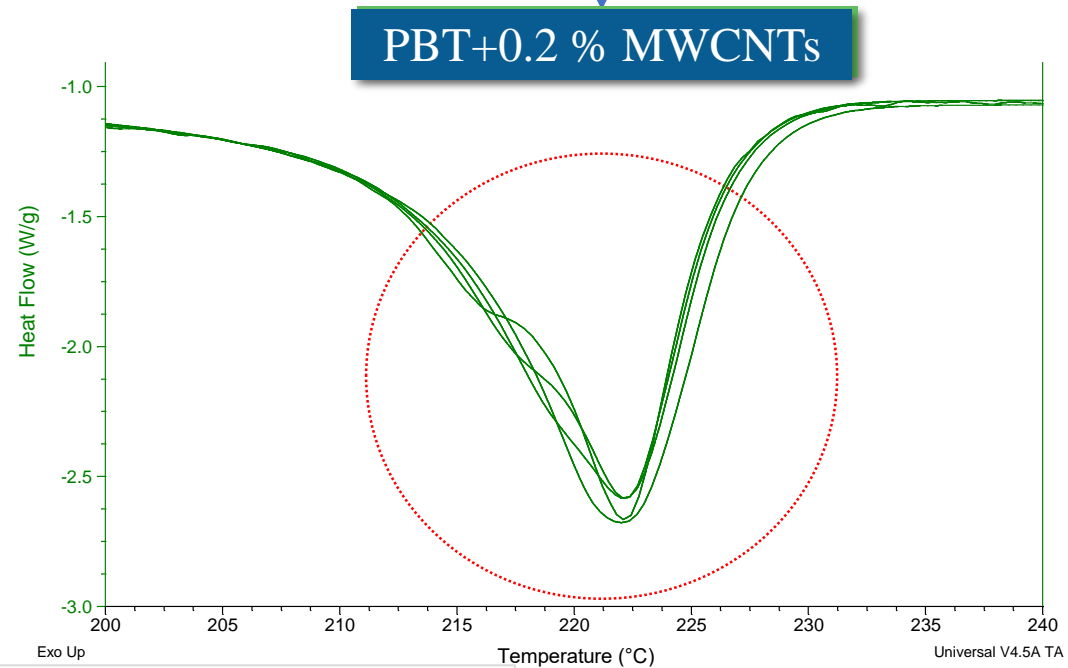
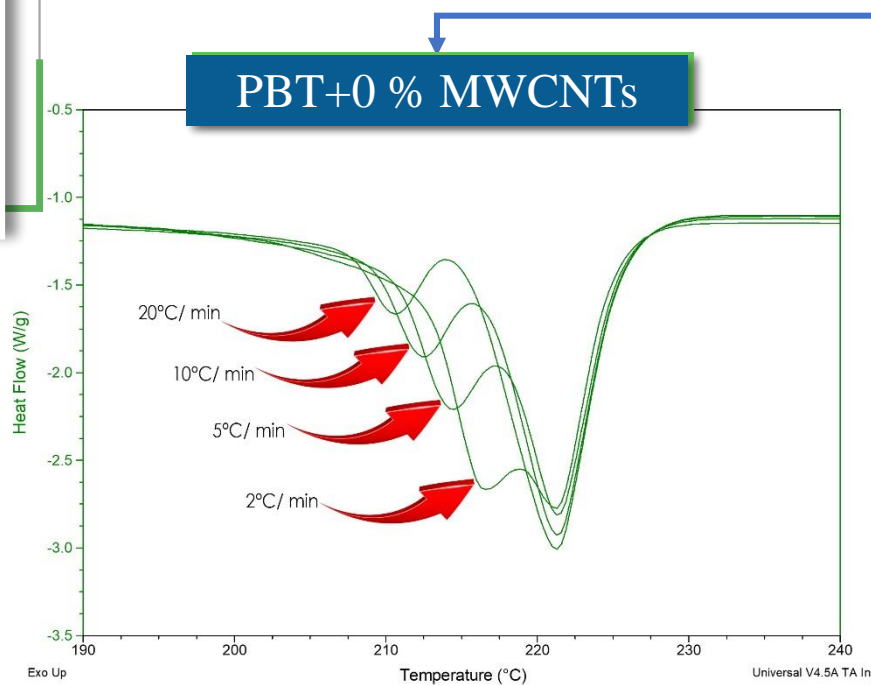


Effect of cooling rates and MWCNTs content on peak temperature of crystallization



The results

Melting

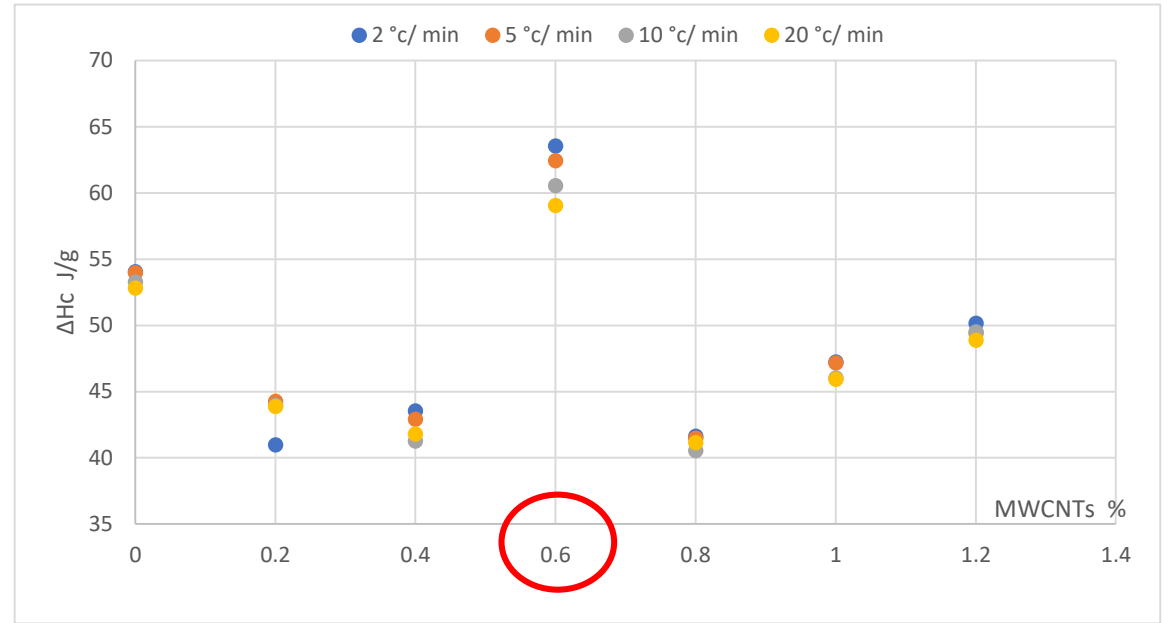


Effect of cooling rates and MWCNTs content on peak temperature of melting

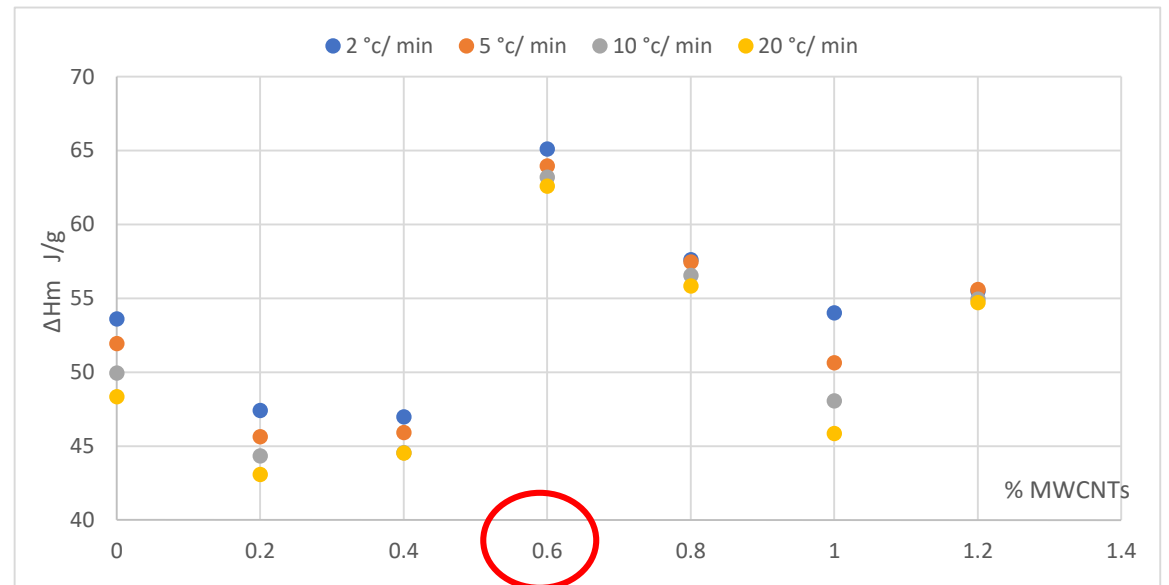


The results

Effect of cooling rates and content of MWCNTs on enthalpy changing of crystallization



Effect of cooling rates and content of MWCNTs on enthalpy changing of melting





Plans for the future

We will do the following

We will do the following

Scan the samples by using scanning electron microscopy (SEM).

Investigation of disappearing of first melting peak.

Study the **mechanical** and electrical properties of the samples.

Isothermal crystallization kinetics of the samples.

Prepare new samples by adding polyethylene terephthalate (PET) with MWCNTs and studying their properties.

Tensile strength.

Hardness.

Impact strength.



Semester Activities

Semester Activities

- I have prepared about twelve presentations 15-20 minutes each. I have explained three of these presentations to students.
- I have explored literature on the research topic (65).
- I have taken the following courses " Investigation of plastics and plastic composites " and " Structure of polymers. " By Dr. Andrea Ádámne Major.
- I am working on a literature review about my topic and the expected publication time is June 2022.



Prepara
Nanocomp

**THANK
YOU
FOR
YOUR
ATTENTION**

