Deformability on warming of plastics (Item No.: P7180700)

Curricular Relevance

Area of Expertise: Chemie
Education Level: Klasse 10-13
Topic: Organische Chemie
Subtopic: Polymerchemie
Experiment: Verformbarkeit beim Erwärmen von Kunststoffen

Difficulty	Preparation Time	Execution Time	Recommended Group Size
Easy	10 Minutes	10 Minutes	2 Students

Additional Requirements:

Experiment Variations:

Keywords:

material property of plastics, deformability

Task and equipment

Information for teachers

Learning objectives

- A characteristic feature of plastic materials is their meltability.
- Plastics can be differentiated by the degree of fusibility.

Notes on set-up and procedure

In general, all plastic samples can be used for this experiment. Particularly suitable are the plastic samples named earlier, taken from the provided sample set, since hereby both fusible (thermoplastics) and non-fusible (thermoplastics) can be used.

Hazard and Precautionary statements

No use of hazardous substances in this experiment.

Hazards

- The plastic samples can drip off burning particles while being heated. Carry out the experiment on a protective desk plate. Wear protective glasses!
- Unpleasant-smelling gases which are harmful to health are evolved on heating! Carry out the experiment in a fume cupboard whenever possible!

Remarks on the students' experiments

The experiment should be carried out under the fume cupboard due to the occurring odour nuisance. When using PMMA it is compelling to perform the experiment under the fume cupboard. Make sure that the dripping plastic material does not drop into the burner nozzle.

Notes

PS and PMMA belong to thermoplastic materials, in which the polymer chains are fixed only by van der Waals forces, whereupon semi-crystalline areas can be formed. For this reason, they are easily fusible, nevertheless, they do not have a defined melting point temperature.
Thermosetting materials are made of covalently cross linking polymer chains which are hardly malleable. Hence, their melting point is so high that they decompose before melting.

Remarks on the method

This experiment - like others from the experimental unit 3 - serve to the study of the physical properties of plastic materials, from which a classification into thermoplastics, thermosetting materials and elastomers (see experimental unit 7) can later be derived.
After having performed all experiments and according to the evaluation table, a description form can be worked out, which contains the physical properties of all examined polymers.

Secondary school (11th and 12th grade): Depending on the foreknowledge of the students, a productive discussion on different bond types and bond enthalpies can follow, in which conclusion about the melting range and the strength of the intermolecular forces can be drawn using the knowledge of the thermal capacity of the used plastic materials from the bond enthalpy CC, CH or CO.

Waste disposal

- Keep recyclable plastic samples.
- The plastic remains and melted pieces can be treated as normal waste.

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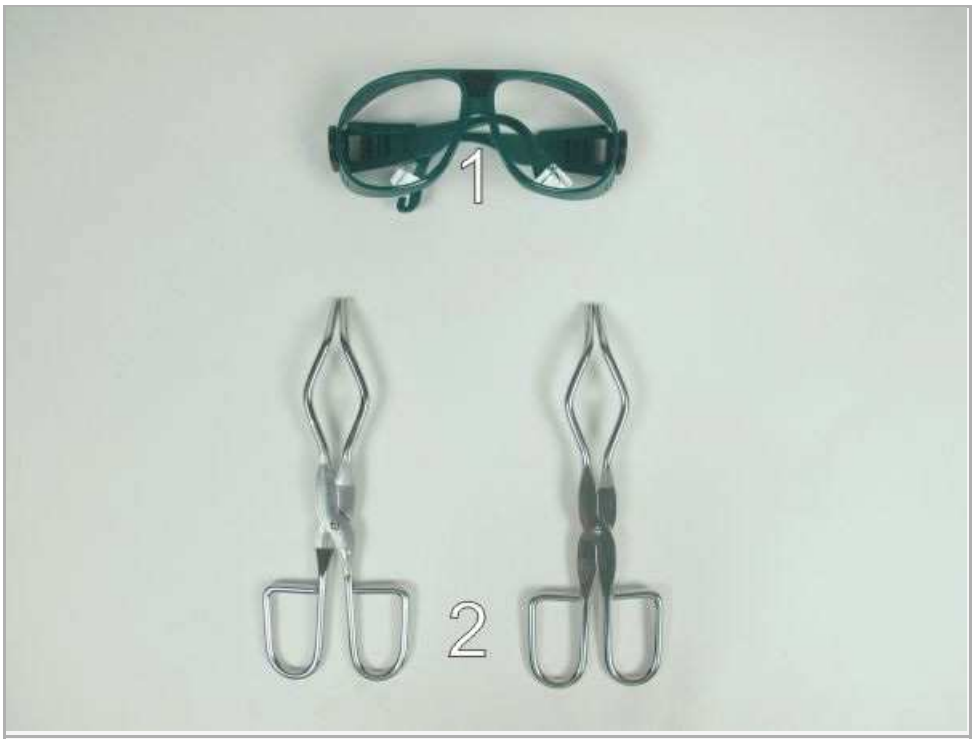
Task and equipment

Task

Which properties of plastics can be examined? (4)

Examine the behaviour of plastic while being warmed.

Equipment



Position No.	Material	Order No.	Quantity
1	Protecting glasses, clear glass	39316-00	1
2	Crucible tongs,200mm,stainl.steel	33600-00	2
	Butane catridge CV 300 Plus, 240 g	47538-01	1
	Butane burner f.cartridge 270+470	47536-00	1
	Protective desk plate 40 x 40 cm	39180-10	1
	Sample set for study of plastics, 60 pcs. of each species	31730-00	
	Lighter f.natural/liquified gases	38874-00	
	Flints, 3 pcs	38874-01	

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Set-up and procedure

Set-up

Hazards

- The plastic samples can drip off burning particles while being heated. Carry out the experiment on a work-table. Wear protective glasses!
- Unpleasant-smelling gases which are harmful to health are evolved on heating! Carry out the experiment in a fume cupboard whenever possible!

Procedure

Procedure

Put the Bunsen burner on the work-table. Take both crucible tongs with one hand each. Hold each of the ends of a polystyrene piece with a crucible tong.

Hold the middle of the polystyrene piece over the non-luminous flame and try to pull it out.
Make sure that any fusing pieces do not reach the burner nozzle (Fig. 1).

Fig. 1

Remove the polystyrene piece from the burner flame and continue holding it over the work-plate.
Proceed in the same way with polymethylmethacrylates and phenolic resin.

Waste disposal

Keep recyclable plastic samples. The plastic remains and melted pieces can be treated as normal waste.

Report: Deformability on warming of plastics

Result - Observations

Write down your observations in general form.

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Result - Table 1

Write down your observations in Table 1.

Plastic sample	Meltability	Deformability
Polystyrene	1	1
Polymethylmethacrylate	1	1
Phenolic resin	1	1

Evaluation - Question 1

Draw the conclusions from your observations.

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Evaluation - Question 2

State your conclusions resulting from this experiment with regard to the applicability of plastics materials.

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Evaluation - Question 3

Which further properties of plastic materials can be examined when heated?

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