



NANOMATERIALS IN PLASTIC INDUSTRY

1. Case metadata

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2. Organisations involved

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3. Description of the case

3.1. Introduction

POLIMARKY (established in 1984) produces a wide range of granulates which are used, among other things, in home appliances, electrotechnic, automotive, building, fixing, toy, decorating and packaging industry. An important part of POLIMARKY production is composite polymers with nanoplates of nanoclays as nanofillers and reinforces.

The company belongs to the category of SMEs (Small and medium-sized enterprise), and is a dynamically developing Polish leader of compounding. The enterprise applies specialised technologies to improve plastics, uses modern equipment and co-operates with academic centres and plastics processing specialists.



POLIMARKY operations are based on the implemented quality and environment management systems, according to ISO 9001:2000 and ISO 14001:2004. In 2009, POLIMARKY implemented regulations to fulfil the requirements of ISO 9001:2008 standard. Assuring safety at work is one of the most important activities conducted at POLIMARKY.

The present case refers to the production of hybrid nanocomposites for thermoplastic materials, developed within the scope of an EU co-financed project as part of the Operational Programme Innovative Economy 2007–2013, Action 4.4. As a result of this project, POLIMARKY has implemented a new production line designed for the manufacturing of hybrid nanocomposites for thermoplastic materials using nanoclays (Nanofil 3000 and Nanofil 3010) as nanofillers. The manufacturing process requires the use of the following components: thermoplastic materials, mineral fillers (glass fibre, talc, chalk) and mineral nanofillers (modified nanoclays).

3.2. Aims

The aim of POLIMARKY's activities was to minimise the risk arising from exposure to nanoplates of nanoclays used in the manufacturing processes of hybrid nanocomposites for thermoplastic materials.

3.3. What was done, and how?

3.3.1. Identification of processes when workers can be exposed to nanoplates.

Nanofil used in the production of nanocomposites is manufactured from natural high purity layered silicate based on montmorillonite. The diameter of the fully exfoliated Nanofil varies between 100 and 500 nm at a layer thickness of only 1 nm. The quantity of that addition usually does not exceed 5% of the polymer weight.

By analysing the technology processes, POLIMARKY has identified operations where workers could be exposed to the nanoplates of nanoclays. These operations include:

- handling operations: during the removal process of nanoclay from bags at the warehouse,
- manufacturing: during the feeding of nanoclay to the melted polymer alloy and during the packing of hybrid nanocomposite granules for thermoplastic materials.
- during cleaning of the process system after each production batch.

It has been found that the highest exposure to nanoplates can occur during the nanoclay removal from bags at the warehouse and during feeding of the nanoclay to the melted polymer alloy.

3.3.2. Protection of workers against harmful substances (including nanoplates) at source

As a result of identifying the processes where employees could be exposed to harmful effects of the raw materials used in the manufacturing process, including nanoplates, POLIMARKY has implemented, among others, specific process solutions (e.g. automated feeding of the nanofiller to the production mixture and sealing of the manufacturing line). Production and storage rooms have been fitted with industrial ventilation systems (general and local), with periodical emissions and dust

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concentration checks in the workrooms. Technical preventive measures have been employed at every stage of handling and nanocomposite production (Figures 1–4).

Figure 1: Raw material warehouse – protection measures – ventilation



Figure 2: Sealed automatic feeder supplying the raw material to the weighing scale



Figure 3: Manufacturing room – protection measures: sealing of the production line and ventilation of the manufacturing room.



Figure 4: Receiving of granulate



3.3.2. Protection of workers against harmful substances (including nanoplates) with PPE

During the preparative handling operations (the removal of Nanofil from bags) and the feeding of nanoclay to the melted polymer alloy, workers are equipped with additional protective equipment, i.e. dust filtering masks, goggles, protective gloves and protective clothing.

Figure 5: Personal protection equipment (PPE) used by workers



3.3.3. Workers' awareness of good practices when working with nanomaterials

POLIMARKY employees are kept up-to-date with information regarding labour environment hazards, including exposure to nanoclay nanoplates. Special attention is paid to the handling operation during the removal of the Nanofil from bags and during the feeding of the nanoclays in order to prevent additional dust emissions during these operations caused by e.g. the shaking of bags, and the opening of bags for later use.

Employees regularly participate in work safety and health trainings. They are aware of the present hazards resulting from exposure to nanomaterials and are acquainted with Nanofil material, MSDS sheets, that are available at the facility [1].

3.4. What was achieved?

- The process line has been designed and built to ensure a high standard of worker protection from harmful effects of chemical substances (including nanoplates).
- Limited exposure to nanoclay nanoplates by a reduction of emission sources: a primary focus on the application of process solutions, i.e. automation of the process of feeding the nanofiller to the production mixture and sealing of the manufacturing line.
- Application, as priority, of collective protection measures – ventilation installed at the warehouse and manufacturing rooms.
- Ensuring high employee awareness regarding exposures to nanoclays, and use of preventive measures.

3.5. Success factors

- Awareness of the benefits of ensuring safe working conditions
- Acquiring funds (activity in fund raising including within the EU)
- Management commitment
- Involvement of the workforce in the development of the company

3.6. Further information

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3.7. Transferability

Apply by POLYMARKY technologies and protection measures of workers against harmful substances at sources are specific for this company. Transferability of these solutions outside of POLYMARY is rather impossible. However, another nanocomposite companies can apply the idea of organising of protection measures in stages of handling and production.

4. References, resources:

1. <http://www.polimarky.com.pl/>