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**Research area: Product aims:**

Raw materials // Chemical additives

**Key words:**

Graphen, barrier, conductivity, strength

**TITLE: Graphenes in coated paper to enhance barrier properties, surface strength and electric conductivity****Background/Problem area**

The Nobelpreis in 2010 has been awarded for two-dimensional carbon structures: graphens. Graphen is structured as a mono layer of carbon atoms and, as a two dimensional material, can hardly classified in common systems.

Product properties of graphen are expected to vary according to its synthesis, i.e. CVD (Chemical Vapor Deposition), GE (Graphite Exfoliation), electro-chemical methods or crystallization processes, because purity and structure and stabilization of particles are influenced by these processes.

Application of graphen in the paper industry as a young material is hardly reported by now.

Graphene can be considered to be the basic elements of carbon nano tubes and fullerenes, which may be included into the investigations.

**Objectives/Research results**

The objective of the research project is to evaluate the potentials of the ne material for applications in paper.

Literature data concerning the application of graphen are collected and the application of graphen in the paper industry is to be evaluated. Expert opinions are considered very important for this evaluation.

Risks in the use of graphen originate in the risk of nano particles in general. Today it is assumed that no hazardous effects are derived from the use of nanoparticles as they are dispersed in water, while dry primary particles are suspect to enter especially the alveols in the lungs and are prone to be cancerogenous.

Many papers have been written on graphen properties, using and enhancing its electronic properties. Barrier properties, strength and surface strength and conductivity, however, are properties, which may be enhanced when graphen is incorporated in paper coatings. An accordance with the technical committee it was decided to follow this application.

This requires to investigate the availability of grapheme on the market. Internet shops indicate a good availability at costs between 200 US\$ for one single freestanding graphen film of some cm<sup>2</sup>, and about 1\$ for one g of nano powder. However, not all products on stock and it often takes months before the product can be delivered. For experiments where the surface properties are investigated it is advised to apply highly purified materials. This purification means that the appearance of carbon black is reduced and conductivity is enhanced as the material shows only 2-3 layers.

Samples of coated papers will be manufactured in the course of the project and their

- barrier against water vapour
- conductivity and
- strength

will be tested in order to derive

**Application/Economic benefits**

Basic information, collected and put together for a special applications, can be the base for further investigations in individual product groups. It is expected that the extremely high aspect ratio can be used for improving barrier properties of packaging paper. Speciality papers which require electrical conductivity or high strength may also be treated with graphenes in order to reach these properties.

The investigation of paper samples coated with a graphen-based coating colour will give rise to other possible applications in the paper industry.

Economic applications will be identified.

Availability, shape and quality of grapheme on the market will be documented..

**Period of time: 01.01.2012 – 31.12.2012**

**Remarks**

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