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**Research area: product aims**

End products made of paper, paperboard and board / other

**Key words:**

switchable polymers, safety, surface, product protection

**Title: New, printable multi-safety label based on hygro/thermochromically switchable polymers****Background/Problem area**

Trademarks are the most frequently infringed industrial property rights today. Losses in turnover caused by counterfeiting are growing dramatically. Counterfeiters copy single product components, complete products or their packages. The market for trademark protection and the necessary safety technologies increases with the amount of losses incurred by counterfeiting. It grows even faster because safety features tend to be forged as quickly as the products themselves.

The use of switchable polymers to obtain new, specific safety features – for example identifiers in the form of “breath signals” – will be studied as a possible novel solution. Switchable polymer brushes that must be stimulated by changes in moisture and/or temperature can produce such “breath signals”. Prerequisite is that they can be functionally linked with the paper surface and provided with the necessary structure.

These issues will be investigated in the project, to finally enable the printing of the new safety feature on paper.

**Objectives/Research results**

**Aim is to link switchable polymers with the paper surface by printing them as structures that are sensitive – i.e. change in response to - moisture/temperature variations. Important results achieved until now are:**

- Investigation and selection of suitable raw materials
- Production of base layers in various compositions
- Selection of suitable polymer brushes
- First conformity tests with polymer solutions (reference material)

Special task is to pre-coat the paper with a smooth layer. This primer must be resistant to solvents and must also have functional groups for the grafting-from process of switchable polymers. It could be shown that the covalent attachment of polymer brushes on pure cellulose surfaces is possible. In this case the modification of the surface is not visible. It is necessary to have a smooth and glossy primer. The work on this is still in process.

**Application/Economic benefits**

The envisaged new product protection based on hygro- and/or thermochromically switchable polymer brushes will respond to exhaled air by changing its structure and, thus, appearance. Economic benefits are expected from the packaging sector, among other, because changing from supplier to branded goods manufacturer is currently the predominant trend in this industry. Its market volume, demand and current amount of counterfeiting clearly justify the development and implementation of a new type of product protection. A high percentage of polymer manufacturing, packaging and printing companies are SME. In the field of plant construction and engineering, at least 200 companies are SME.

Apart from adding a new product to their portfolio (polymer production), the application of a new, improved and forgery-proof product protection technology will also enable these companies to secure and improve their turnover and market position.

**Project period: 01 January 2014 – 31 December 2015**

**Remarks**

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