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**Research area: Product aims**

Paper, paperboard and board // Technical speciality papers

**Key words:**

Electromagnetic compatibility, absorption and reflection of microwave radiation

**TITLE:****Functional specialty papers for shielding electromagnetic radiation****Background/Problem area**

In the last few decades, people have been exposed to increasing amounts of electromagnetic radiation, above all in the microwave range. Alternating electromagnetic fields with frequencies in the range of 300 MHz to 300 GHz are usually identified as "microwaves". Microwaves are used in a broad range of common devices, e.g. a wireless LAN operates at 2.4 GHz or 5 GHz, respectively, Bluetooth and microwave ovens both operate at 2.4 GHz, or radar-based parking sensors operate at 24 GHz. These are just a few examples, but they prove the widespread use of this type of radiation.

In Germany, the 26th Regulation for implementing the Federal Immission Control Act (Regulation on Electromagnetic Fields - 26th BImSchV) includes requirements intended to protect the general public from the harmful environmental effects of electromagnetic fields or for electromagnetic compatibility, respectively.

In addition, a survey carried out by the European Commission reinforces the need to find an adequate solution for these problems. The survey showed that 46% of the interviewees are worried about possible risks to health from electromagnetic fields.

The aim of the research project is to develop a technical specialty paper which is capable of attenuating high frequency electromagnetic radiation, thus offering an opportunity to comply with the limit values of the regulation on electromagnetic fields (26th BImSchV). This objective is to be achieved by a thin, highly reflective undercoat, based on sol-gel materials and conductive pigments which inhibit the transmission of electromagnetic radiation as well as an absorptive top layer which reduces the radiation. Furthermore, a suitable application procedure for applying the coating colour will be developed. In order to increase the absorption of the pigments, plate-like reflecting pigments are implemented to supplement the absorbing pigments which lead to multiple undirected, diffuse reflections. As a consequence, the path of the electromagnetic radiation through this layer is increased significantly and the absorptivity of the active pigments is enhanced. Different metallic materials of various shapes could be dispersed in conventional binders like PVA and Styrene-Acrylate. Furthermore, these metal-based colours could be coated on a base paper by using common application methods like a laboratory rod.

It was also possible to disperse absorbing pigments like carbonyl iron, ferrites or absorbing metals, into calcium carbonate based coating colors, as well as in binders without calcium carbonate. These coating colors could be coated using conventional laboratory rods. Furthermore metal pigments could be incorporated into these coating colors, too. Thereafter both types of pigments have been combined in a single absorbing coating layer. In the end the reflective and the absorbing layers have been combined in a two layer coating system. At last the technical properties, the commercial aspects, as well as the recyclability were analyzed.

**Application/Economic benefits**

Based on the knowledge acquired, small companies are given the chance to use new materials for new products, thereby producing such new products. Small paper producers in particular can benefit from this project because of their small paper machines with small working widths and minor production units. They will be able to manufacture such high-tech papers batch-wise in small quantities. These companies will be able to establish new high-tech products on the market, which protects existing jobs and helps create new jobs.

An analysis of the estimated costs shows that this type of coating qualifies as an economic alternative to traditional products whose costs range between 15 €/m<sup>2</sup> and 40 €/m<sup>2</sup>. In comparison to that, the costs of the newly developed coatings range in the area between 3 and 4 €/m<sup>2</sup>. To apply this coatings conventional manufacturing processes can be used, therefore no or at least just small investments are necessary to adapt this technology.

In addition, those companies that produce conductive and absorbing pigments, further processing companies can tap into new markets and expand the range of their products or services.

**Period of time: 01.02.2014 – 31.01.2016**

**Remarks**

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