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Research area: Product aims

Paper, paperboard and board // Technical specialty papers

Key words:

Metal, metallic paper, filtration, porous media, semi product, sintering, fleece

TITLE:

Metallic sinter papers and sinter fleeces

Background/Problem area

The production of porous metallic materials is state of the art. In most cases, classified metal powders, but also thin metal fibres are poured into moulds and afterwards sintered. The generated sintered mouldings show wide pore dimensions.

Porous 'wide & flat sheet' products in the form of foils and tapes have rarely been produced by conventional means up to now. Basically, two procedures are suitable for producing porous foils and tapes: powder rollers and tape casting. Nevertheless, tape casting is not very cost effective as only low process speeds can be realised. In addition, sedimentation effects occur when producing thicknesses of more than 250 µm. Furthermore, the width has been limited to 200 mm up to now. Powder rollers require high pressure within the nip to produce tapes. This causes relatively high compression. The maximum porosity is about 20%. The maximum thickness is about 200 µm.

This project aims at using highly efficient paper and fleece production technologies to develop flat semifinished products (sinter papers and fleeces) which are filled with metal powders or metal fibres. These metallic semifinished products are processed afterwards, e.g., to winding cores or folded structures. These structures can be used directly or can be sintered to form porous or highly porous metal sheets.

Objectives/Research results

By using paper and fleece processing procedures, equipment and styling, structures with complex shapes shall be generated which cannot be realised using classical powder metallurgical procedures (extrusion, hose downpour). These semifinished products filled with metal powders or metal fibres are either used directly after processing depending on the application. Or they can be debindered and sintered to form porous or highly porous metallic materials. The proposed material development is based on different combinations of metal powders and fibres. Gradients within the pore size distribution shall be generated using multi-layer material and coating variations. The project focuses on water filtration applications and the principal technical and economic potential. In addition, lead or zinc will be checked to the production of flexible electrodes or for radiation protection.

A subproject deals with developing metallic sintered papers that are application-oriented and that meet requirements. Comprehensive laboratory-scale trials were conducted to develop a suitable retention-binder system and to produce paper on a laboratory scale. Promising variants were subjected to sintering. Based on the results of the sintering behaviour, the metallic sintered paper was adapted in an application-oriented manner with respect to the processing properties of the green compact as well as to the functional properties of the sintered materials (sintered structure – e.g. mechanical stability, filtration behaviour). The work focused in particular on the contributing factors: the type of metal, the combination of metal powder and metal fibres as well as the kind of paper fibres used. Trials conducted on the pilot paper machine verified that such metallic sintered papers can be produced in a continuous manufacturing process. The paper machine trials provide the material for forming and converting. At the same time, the trials provide the material for development and production of the demonstration models.

Application/Economic benefits

Typical applications might be filtration, sound absorption, heat exchanger, pore distiller, catalysts, etc.

Metallic materials can be cleaned well, can have high mechanical strength and also be started up at relatively high temperatures. Metal-based filters have been successfully used in water filtration, garbage combustion arrangements or power stations. However, porous sintered metals are also being used as an evaporator in different areas, e.g., in chemical process technology and biotechnology. Another interesting field of use explains the application as a flame-restraining element, e.g. in gas cylinders. Great importance also exists in the use of porous sintered metals for the efficient distributon of gases and liquids. For a few years now, metallic fibre-based highly porous materials have been used as surface distillers. New areas of application are electromagnetic screenings and sensors.

The research results shall be used by paper production and converting plants in Saxony. Secondly, they will have an impact on the future trend of Saxon SMEs (small or medium-sized enterprises) in filtration and environmental industries. Low cost applications of porous metallic sheets produced by paper and fleece processes could evolve into a totally new market for Saxon firms once the current technical problems such as porosity and strength has been solved within the scope of the research project.

Period of time: 01.07.2011 – 31.10.2014

Remarks

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