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**Research area: Product aims**
Paper, paperboard and board // Technical speciality papers

**Key words:**
Shaped wooden parts, expancel, leight-weight construction, wood materials

## Title: Production of light-weight 3D shaped wooden parts by a paper-based core material

### Background/Problem area

Until now, shaped wooden parts could be manufactured as one-piece parts with a more or less uniform structure. As a result, they weighed more or less as much as most parts made of plastic-based shaped parts. Lighter weights, however, would be advantageous, especially in the automotive engineering and aircraft construction. The advantages of shaped wooden parts are manifold and diverse. They are characterised by high dimensional stability, can be manufactured in a purpose-optimised manner and exhibit high degrees of freedom in shaping and design. Shaped wooden parts can be subjected to high loads, are ecologically unproblematic and can be thermally utilised or recycled without any problems at the end of their life cycle. Since they normally do not splinter, they are attractive in the construction of cars and mobile homes due to the favourable properties they exhibit in the event of accidents and crashes.

To date, 2D or 3D shaped sandwich materials have been manufactured, but only in combination with metal- or plastic-based composites. In light of the anticipated objectives of material savings and weight reduction, 3D shaped wooden parts in a sandwich construction with a light-weight foam core would offer a great advantage. There is currently no suitable technology for producing light-weight and voluminous paper-based core materials that could be used to manufacture 3D shaped wooden parts in a sandwich construction.

### Objectives/Research results

This project is designed to develop a specialty paper (carrier matrix) which contains a defined concentration and distribution of thermally foamable, but non-expandable Expancel® microspheres. The process of producing the specialty paper must be designed in such a way that the microspheres do not expand prematurely and can be blended homogeneously into the fibre network with a controlled particle density.

Within the scope of this project, it is planned to introduce the microspheres into the intermediate ply of 3D shaped wooden parts. It should be possible to produce 2D or 3D shaped sandwich parts in a single work step using a core material precursor based on a specialty paper. The various components are placed one above the other and introduced into a press. During the pressing operation, the top plies are first pressed together and allowed to cure, whereupon the intermediate ply is then foamed once the press has been opened slightly by a tool-path control.

The paper-based precursor is to be used both for fibre-, chip- or veneer-based shaped parts. Another project objective is to use this matrix as a core material precursor for multi-ply packaging and engineering materials.

One- and two-ply paper filled with as much as 60 % Expancel® microspheres have already been produced on a pilot scale, and Expancel® microspheres have also been introduced between two tissue layers through a slot nozzle in an alternative trial.

In light of the results obtained from trials on the foaming behaviour of the manufactured paper, the production technology had to be adapted. The grammage, the pulp used and the choice of additives were optimised as a result.

The production of the Precursoren occurred with all series of experiments under gradation of the grammage of the papers or the grammage of the microspheres. This allows the specific construction of the intermediate ply of 3D shaped wooden parts with gradated grammages by combination of the precursores.

### Application/Economic benefits

The specialty paper developed within the scope of this project expands the product portfolio of small and medium sized enterprises. New sales markets for paper products such as light-weight construction and the building materials industries can be can be opened up in view of these innovative paper grades. In addition to being used to produce shaped wooden parts, these light-weight materials may also be found to be useful in future in other sectors such as paper converting or packaging technology. The manufacturers of shaped wooden parts can profit from considerable economies of materials, thus achieving more cost-effective and ecological processes for manufacturing furniture and structural elements (e.g. for interior decoration and for use in automotive engineering).

The manufacture of wood-based shaped parts with a paper-based foam core, however, requires adaptation of the pressing technology which in turn must be implemented by equipment manufacturers. This would also give an innovative impetus to specialty machine manufacturers (pressing moulds, press construction) who tend to be small and medium sized enterprises in most cases. Consequently, this would give these firms a unique cutting edge over foreign competitors.

**Period of time: 01.01.2008 – 28.02.2010**

### Remarks

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