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Research area: Product aims

Paper, paper board and board // Papermaking

Key words:

Ceramic, preceramic papers, high temperature, specialty paper

Title: Steering key properties of paper derived ceramics by designing their microstructure**Background/Problem area**

Ceramics are commonly used in high temperature applications due to the high temperature and high thermo shock resistance. Typical application areas for ceramic materials in this context are for example kiln isolations or kiln furniture. Because of increasing energy costs ceramic light weight structures gain more and more in importance due to less thermal mass. Paper derived ceramic light weight structures show high potential in these application areas. In previous research projects it was shown, that highly filled preceramic papers can be converted into ceramic materials by sintering. In this basic projects no systematic study of the thermo mechanical properties of paper derived ceramics was conducted.

Objectives/Research results

Objective of the project is the systematic study of the thermo mechanical properties of paper derived ceramics. The controllability of these properties by paper technological parameters is to be shown in laboratory as well as pilot plant scale. The application potential of paper derived oxide, carbide and silicate- based ceramics is to be evaluated.

Given by a table and therefore comparable to common technical ceramic systems the relevant thermo mechanical properties are to be investigated in dependence of paper technological parameters like filler content, filler particle size, kind and content of cellulose fibres as well as degree of compaction due to calendaring. This data is planned to be the base for further product development in the area of high temperature applications.

The screening of ceramics derived from aluminium oxide, mullite and cordierite filled paper was performed according to the work plan. The achieved thermo mechanical properties are comparable to common technical ceramics with comparable porosity. In a next step the controllability of these key properties by paper technological parameters and the optimisation is to be performed by following the design of experiments (DOE) procedure. Using a multiple regression analysis it was demonstrated that the important key properties of the paper derived ceramics can be predicted by paper technological parameters with high coefficients of determination. The resulting model was used to calculate optimized variants e.g. by means of strength or porosity. The model was proved by realizing and characterizing the calculated variants. In the following project phase the optimized variants were successfully transferred from lab scale to pilot plant scale to demonstrate the applicability of a continuous production process. Based on the archived properties of paper derived ceramics specific possible applications were recommended.

Application/Economic benefits

Preceramic papers as speciality papers are a new interesting product particularly for small and medium-sized enterprises (SME) in the area of paper production. SME are flexible enough to incorporate new speciality paper species in their product portfolio. In addition to that smaller masses of preceramic papers as precursors for ceramic products fit to their business model.

Preceramic papers represent a new and interesting ceramic precursor material. Based on the project results the potential of this precursor material for high temperature applications is derivable. Ceramic industry in cooperation with paper industry will be able to start concrete product developments in the area of high temperature applications based on paper derived ceramic materials.

Project period: 01.07.2008 – 30.06.2010

Remarks

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