

# Fiber Composites Manufacturing

## FEEDSTOCK CLASSIFICATION

Lignocellulosic biomass

## FEEDSTOCK EXAMPLES

- [Alfalfa](#)
- [corn stover](#)
- [crop residues](#)
- [forage grasses](#)
- [forest residues](#)
- [municipal solid waste](#)
- [paper mill residue](#)
- [sawdust](#)
- [switchgrass](#)
- treated wood wastes
- [waste wood chips](#)
- [wood chips](#)

## PROCESS DESCRIPTION

Cellulose fibers have inherent properties, such as tensile strength and density, that can add considerable value to durable materials. These include products ranging from fiberboard, whose solids are almost entirely wood-based, to siding, where the woody content is there to supplement cement. Such wood composites have been manufactured for decades, but have primarily used virgin wood to supply the fiber. A number of technologies are being developed that can produce high-quality materials with low-value lignocellulose streams that have previously not been exploited by industry.

Dow BioProducts Ltd. has developed a wheat straw-based fiberboard, Woodstalk<sup>1</sup>, that can replace medium-density fiberboard (MDF) and high-quality particleboard. In addition to meeting all necessary performance standards, Woodstalk is easily machinable and lighter than competing all-wood products. Additionally, the processed wheat straw has a more uniform particle size than those used to make MDF and particleboard, resulting in more consistent final products. Dow does not license this technology, but their commercial deployment of the Woodstalk product demonstrates the viability of building materials made from sustainable resources like grasses.

Phosphate ceramics developed by Argonne National Laboratory can replace traditional cement in durable building products such as sheathing and door cores, and should offer mechanical advantages over existing products including strength, density and flame resistance. Phosphate ceramics can encapsulate low-level hazardous wastes without leaching, which allows for the safe recycling of paper mills residue and treated wood. Because of the cement-like nature of the ceramic, wood wastes do not have to be dry to be used – in fact, the moisture present in the wood wastes can be beneficial because it helps to wet the ceramic.<sup>2</sup>

These innovative processes join established wood waste recycling products, such as the use of sawdust in extruded plastic composites.

## **PRIMARY BIOBASED PRODUCTS**

### **Durable building materials**

#### **MAJOR EQUIPMENT**

Much of the development of novel wood composite manufacturing is focused on maintaining compatibility with the existing production infrastructure. For instances, fiber-bonded products made with phosphate ceramics can be made in much the same way as products made with cement.

#### **ENERGY REQUIRED**

In many cases, the net energy required will be less than that needed to make similar products with virgin wood because of the energy-intensive harvesting process.

#### **CAPITAL AND OPERATING COST**

Varies by process

#### **COMMERCIALIZATION STATUS**

Varies by process. The use of phosphate ceramics in wood-based durable building materials is still being researched. Dow's Woodstalk product is commercially available.

#### **COMMERCIAL SUPPLIERS**

The manufacture of durable building materials with paper mill residue is being primarily investigated in the US by the University of Minnesota-Duluth National Resources Research Institute.<sup>3</sup> Argonne National Laboratory<sup>4</sup> has started to commercialize its first phosphate ceramic, Ceramicrete, and is developing variants tailored for wood products.

Dow BioProducts Ltd.<sup>5</sup> is a subsidiary of Dow Chemical Canada Inc. and is developing additional agrifiber products.

#### **REFERENCES**

<sup>1</sup> Industrial Panels. Dow BioProducts Ltd. <http://www.dow.com/bioprod/prodapp/panels.htm> (23 April 2004).

<sup>2</sup> Technology Transfer at Argonne. "Commercialization and Licensing Opportunity: Chemically Bonded Ceramic." Argonne National Laboratory. <http://www.techtransfer.anl.gov/techtour/ceramicrete.html> (23 April 2004).

<sup>3</sup> National Resources Research Institute. <http://www.nrri.umn.edu/> (26 April 2004).

<sup>4</sup> Argonne National Laboratory, 9700 S. Cass Ave., Argonne, IL 60439, 630.252.2000 <http://www.anl.gov> (26 April 2004).

<sup>5</sup> Dow Bioproducts Ltd., 4520 East Ashman St., Bldg. 9008, Midland, MI 48642, 800.441.4369 <http://www.dow.com/bioprod/> (26 April 2004).