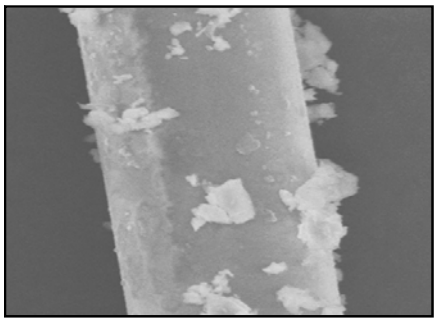
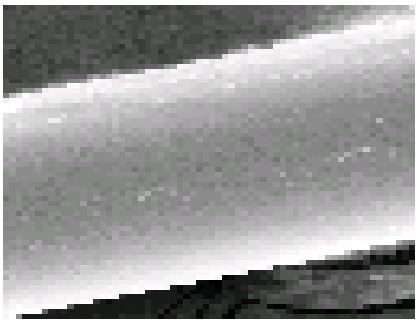
Development of a Process for the Recovery and Recycling of Glass from Glass-Manufacturing Waste

New Separation Technology Allows Glass Manufacturers to Recycle Glass Waste Streams

The glass fiber industry produces three solid-waste streams: glass-fiber-forming waste, fiberglass-manufacturing scrap, and fiberglass-product scrap (end-of-life scrap). The glass-fiber-forming waste is "spaghetti-like" with varying diameters and varying in lengths up to a few feet. It has a wide range of polymeric coatings or binders on the surface that are not compatible with the glass. These coatings must be removed before the glass-fiber waste can be recycled. Tiny noble metals particles that erode from the bushings also have to be removed for efficient recycling of the fibers. Recycling of this waste without removing the polymeric-coating and the metallic particles has resulted in an increase in the number of filament breaks occurring in the glass-manufacturing process. This increased breakage rate subsequently increases the amount of waste generated. Therefore, this non-biodegradable waste continues to be landfilled. Argonne National Laboratory developed a process to remove the contaminants so that the glass fibers can be recycled. The process also recovered glass fibers from fiberglass-manufacturing scrap and fiberglass end-of-life products.



A Glass Fiber Before Treatment



A Glass Fiber After Treatment

Benefits for Our Industry and Our Nation

- Reduced glass fiber production cost
- Reduced consumption of raw materials
- Reduced energy consumption
- Reduced waste generation

Applications in Our Nation's Industry

Some fiberglass insulation manufacturers in the United States can benefit by using this process for recycling their wastes.

Project Description

Goal: Develop a technology that will enable the textile fiber industry to recycle its glass-fiber-forming and fiberglass-manufacturing scrap into new glass or into new glass products without either adversely impacting its operations due to the increasing glass-filament breakage rate, or the quality of its products.

The project approach consisted of the following tasks:

I. Establish technical feasibility. Thermal and chemical methods to liberate the glass fibers from the binger material were tested.

II. Conceptual designs for integrating the process with existing glass operations were developed.

III. Economic analyses of the processes were performed.

IV. Environmental emissions from the processes were determined.

V. Industry was contacted to demonstrate the process in the field.

Project Accomplishments

The research resulted in the development of a process that removed contaminants and impurities from glass fiber waste and from fiberglass scrap so that the glass fibers can be recycled into value added products. In the case of the glass fiber manufacturing waste the process consists of two basic steps: (1) Washing of the waste fibers to remove excess coating solution which also contains tiny metal particles that abrade from the dies during the manufacturing process before it solidifies on the fibers, and (2) Thermal treatment of the waste fibers at temperatures below the melting point of the fibers to breakdown and oxidize the polymeric coating layer on the waste fibers. The technology was tested in the laboratory in batch and in continuous reactors and was found to be effective in removing the impurities and contaminants. The chemistry of the recovered glass fibers was essentially the same as the chemistry of virgin glass. Economic analysis of the process showed a potential payback of less than two years. In the case of the fiberglass scrap, where the only contaminant that is of concern, is the polymeric-binder, washing of the waste is not necessary.

Outlook

One of the industrial partners, CertainTeed, successfully implemented a new method of scrap insulation fiber recycling as a direct result of the information gained during the project in one of its plants in the United States. The energy savings from recycling the scrap fibers was approximately 0.7% for the glass furnace tested. Of additional benefit to both the company and the environment is the cost avoidance of not sending over 1000 metric tons of scrap to landfill, resulting in an annual savings in excess of $40,000. Furthermore, this also reduced requirements for raw materials, saving additional energy in the mining and shipping of these materials. CertainTeed has also filed a patent application as a result of this work.

Another major U.S. glass fiber manufacturer has contacted Argonne National Laboratory and is interested in pursuing a partnership that ultimately helps to reduce waste to landfill through the commitment of resources necessary to further this technology.

Project Partners

Argonne National Laboratory
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Saint-Gobain Vetrotex America
Wichita Falls, TX

CertainTeed Corporation
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