



All Coal Anode

Collaborators: West Virginia University, Koppers Inc., Alcoa.

Description: The CPCPC has sponsored several research programs seeking to develop non-petroleum alternatives for products such as anode-grade coke and binder pitch, both of which are used in the metals smelting industry. Currently, the main sources of raw material are petroleum and coal tar (derived from metallurgical coke ovens). Hence, environmentally clean yet economical alternatives are urgently needed in order to maintain a vibrant metals smelting industry in the United States. A landmark effort to consider processed coal as an alternative was sponsored by the CPCPC in the form of the “All Coal Anode” project in 2001. A collaborative project between West Virginia University, Koppers Inc. and Alcoa, it led to the development of test anodes representative of those used for aluminum smelting. The “All Coal Anode” project produced materials that met or exceeded every industry standard for both binder pitch as well as anode-grade coke. This success led to other research and development efforts, mainly funded by the U.S. Department of Energy, through its National Energy Technology Laboratory, to develop processes with enhanced economics for carbons for metals smelting applications.

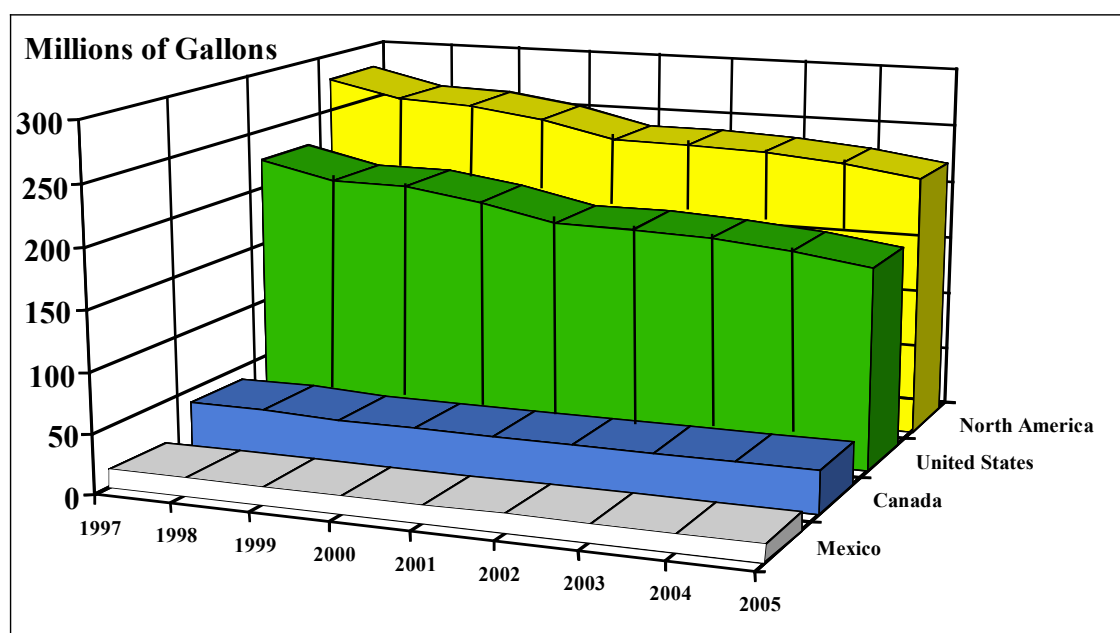


Figure 1. This graph from Koppers Inc. shows a continuous decline in binder pitch production. To reverse this long-term trend, synthetic binder pitch is needed.

The university/industrial team has created an environmentally clean process for producing binder pitch using raw coal as the main feedstock. The process uses hydrogenated solvents to dissolve coal, allowing removal of mineral matter via centrifugation. The resultant clean feedstock is then distilled to create binder pitch, and the coal solvent is recovered and reused. The team achieved several technical advances. First, an effective coal solvent was created by using a mild hydrotreatment of coal liquids resulting in a much more economical solvent than previously achievable. Second, the amount of hydrogen used was a factor of ten less than previously believed to be necessary. Third, about 90% of the dry-ash-free coal was successfully liquefied.

Commercial trials for binder pitch are scheduled to begin in late November 2007. The binder pitch has been incorporated in arc furnace electrodes manufactured by GrafTech International Holdings Inc. Twenty-one such electrodes have been produced, measuring 20 inches in diameter by 96 inches in length, and weighing over 3/4 of a ton each.



Figure 2. In November 2007, synthetic binder pitch will be tested in commercial GrafTech electrodes.

The solvent extraction process is inherently clean and results in a dramatic reduction of air emissions during manufacturing binder pitch. In addition, the nature of coal-derived products results in superior quality for carbon and graphite products, and the low cost of the feedstocks can result in improved economics for the pitch production industry.

Accordingly, plans for larger-scale production are in the works. A worldwide synthetic carbon products industry is emerging, with similar projects having now been started in countries such as South Africa, Japan, China and elsewhere.

Contact: Elliot B. Kennel, West Virginia University Chemical Engineering, PO Box 6102, Morgantown WV 26506, 304-293-2111 x 2423, Elliot.Kennel@mail.wvu.edu.