LETTER FROM LONDON

Getting in on a new thing

Britain's carbon fibers give industry a leg up

by Larry Miller

British industry, which has to export to live, is constantly in need of new technologies that can give its products an advantage in foreign competition.

The current technological fever is over carbon fibers, which, used as reinforcers for plastics, promise lightweight strength at low cost. The technology has been around for several years (SN: 6/24/67, p. 588), and has now reached the point of commercial application.

But the question is whether Britain's industry will be in a position to utilize its early start before it is overtaken by American competitors.

The question has been raised by the Select Committee of the House of Commons. The answer, according to the committee, is that somehow or other a way must be found, and immediately, of manufacturing carbon fibers in Britain on a large enough scale and at a cheap enough price to induce industry to use them.

Once an outlet has been established the price will come tumbling down, it is hoped, and the market will open up for further exploitation.

Carbon fibers, no thicker than a human hair, provide a material that engineers and space scientists have long dreamed about. Stronger and stiffer than steel and light as plastic, they are ideal for reinforcing plastic materials and others. And apart from the fact that they oxidize in air at 400 degrees C. (remaining stable up to 200 degrees C. in reducing atmospheres) they have few drawbacks.

Like most strong materials they derive their properties from their fine crystal structure.

In the United Kingdom, the starting material is a synthetic fiber, polyacrylonitrile, which is heated to about 300 degrees C. while being held under constraint, to prevent it from shrinking. It is then heated to much higher temperatures to produce a fiber markedly different from the original. The end product contains numerous graphite crystallites aligned along the axis of the fiber.

In the U.S., the method, as developed by Union Carbide, starts with rayon fibers, which are heated to produce a fibril structure, then stretched while hot to pull the tiny crystals into alignment along the fiber axis, thereby increasing fiber strength to its maximum.

But the method of production is not the principal reason for any likely differences in carbon fiber development. The principal reason is more likely to be the rapidity of application. In the U.S. industries such as aerospace and defense offer an excellent outlet for commercially untried material such as this, since they do not always need to prove commercial viability. They have already been used in the U.S. space program in reentry vehicles. Britain has few such industries, so she has to rely on far-sighted firms such as Rolls Royce to incorporate the fiber in its new RB 211 turbine blades. This proposed venture has already brought in $430 million worth of orders.

But what is practicable for Rolls Royce, with its immense resources, may not be so for others. The company has already made it plain that it does not intend to rely on outside development; it needs carbon fiber technology now, and it needs it in a hurry. To achieve this it is building its own plant.

Other firms at present are relying on two companies. Courtoulds Ltd., which specializes in fibers, and Morgan Crucible Ltd., high temperature specialists. Both companies have been granted licenses by the Government's National Research and Development Corporation to manufacture and sell the fiber. And both companies have made it clear to the Select Committee that they do not intend to short circuit the traditional pattern of supply and demand. So it seems that the material will be at first excessively expensive, $250 per pound, coming down to perhaps $70 per pound, and eventually to perhaps $12 per pound.

This might be acceptable were it not that these two companies have recently negotiated agreements with U.S. companies, Hercules, Inc., Wilmington, Del., and Whittaker Corp., Los Angeles, for manufacture of the fiber in the U.S. using the British process. The danger here is that the U.S. companies, with access to aerospace and defense contracts, could increase their rate of production faster than the licensers. So it might soon become cheaper for British firms to import the fiber from the U.S. than buy it on the home market.

The question of increasing the rate of expansion on the home market depends on appreciating the technological potential of carbon fiber. So far, it has been used only for compressor blades and engine parts. But there is a host of other applications. Engineering components of all sorts, from bearings and gears to generators, cables and pylons, all provide an excellent outlet. Then there are pressure vessels, on land, on sea, and above or below the sea.