Technology

Rocketing to liquid fuels from coal

The same scientific principle that allows a rocket to blast off or thrusts a jet aircraft through the air is now being applied in a process for converting coal into a mixture of liquid and gaseous fuels. The key piece of equipment is a small reaction chamber equipped with a nozzle. Streams of powdered coal, steam and oxygen, continuously fed into the nozzle region, rapidly mix, react and shoot out of the reaction chamber. The resulting product is a mixture of methane gas and liquids like benzene.

The advantage of using such a high-speed process, says John S. Wilson of the Department of Energy's Morgantown (W. Va.) Energy Technology Center, is that an immediately usable, high-quality liquid fuel is produced along with the gases. The reactions occur over such a short time span that coal molecules fail to break down completely into gas molecules. Other coal gasification processes, which are generally slower, produce only gases. "The way the coal molecules come apart is very much affected by the time and temperature history they undergo during gasification," says Wilson.

This "rocket" process, called "advanced flash hydropyrolysis," was developed by Rockwell International of Canoga Park, Calif., with help from several international energy companies and the Department of Energy. This summer, the company plans to test an experimental unit that processes about one ton of coal per hour to see if the technology is worth developing.

Brittle steel: Into the mild blue yonder

When neutrons bore into a chunk of pure iron, they cause considerable damage by dislocating iron atoms, creating defects and vacancies within the material. As a result, the metal becomes more brittle and prone to fracture. However, the situation may be somewhat different when the material is an alloy like steel and contains impurities. In the March 1 NATURE, K. Linga Murty of North Carolina State University in Raleigh reports that at least one type of steel is much less sensitive than pure iron to neutron radiation. Moreover, neutron irradiation helps suppress another form of brittleness that arises because impurity atoms sometimes migrate throughout the material.

Murty's research involved "mild steel," which contains up to 0.25 percent carbon. At temperatures above 200°C, carbon and nitrogen atoms held within the steel begin to migrate and collect at dislocations and grain boundaries within the material. This results in a phenomenon called "blue brittleness," which makes the steel more likely to fracture. Murty found that irradiating the steel shifts the onset of blue brittleness to a much higher temperature. Murty notes, "To my knowledge, such improvement has never been observed before." He postulates that defects caused by the neutrons trap migrating carbon and nitrogen atoms and prevent them from concentrating in just a few locations. The next step, Murty says, is to see if blue brittleness occurs in similar steels used to make pressure vessels for nuclear reactors. At present, nobody takes this phenomenon into account when studying the properties of pressure-vessel steels, he says. Irradiation may improve such a steel's quality at higher temperatures.

A bacterial assist for pipeline flow

Many crude oils are too thick or viscous to be moved long distances through pipelines. One answer is to mix the oil with a liquid like water, but then an emulsifier is needed to keep the oil and water from separating during transport. Recently, researchers at Petroferm USA in Short Hills, N.J., reported success in getting a species of bacteria to produce an effective "bioemulsifier" for this purpose. The microbe-produced substance can keep oil and water mixed for days, even in the event of a pipeline pump failure.

Behavior

Teen suicides: Is there a pattern?

Tragically, several communities around the country have experienced epidemics of teenage suicides. Most recently, there have been five teenage suicides since early February in New York City's northern suburbs. It is not clear whether a sixth death was intentional or accidental. Is there a contagious effect that one or more suicides have on other troubled youngsters?

There are no answers at this point, but an initial effort to analyze clusters of teenage and young adult suicides is being prepared by the Centers for Disease Control (CDC). Preliminary statistics on the extent of the problem are expected to appear in CDC's "National Suicide Surveillance Report," due for publication by early summer.

The data will focus on young people ages 15 to 24, says CDC epidemiologist Michael Gorman. In this group, there has been a 41 percent rise in suicides over the past decade. Young single males are especially prone to suicide, notes Gorman. The suicide rate for men ages 15 to 24 has risen by about 50 percent over the last 10 years. Suicides among women in the same age range have increased by 12 percent since the early 1970s.

Putting the finger on assassins

A 25-year-old man was shot and wounded just outside the White House fence on March 15 when he reached for a sawed-off shotgun as a uniformed Secret Service agent approached. The incident occurred, ironically, shortly after a report was released advising the Secret Service to provide agents with more training in mental health concepts and skills, in order to better identify potential assassins of political figures.

The report, issued by an Institute of Medicine committee composed of physicians and behavioral scientists, says increased training could help agents pinpoint individuals who are serious threats to the president or other persons they are protecting. Last year 4,000 persons threatened to harm officials under Secret Service protection. Of that number, 54 percent — and 95 percent of the 350 of those 4,000 the service considers dangerous at any given time—have a history of mental disorder.

The committee, organized in 1981 at the request of the Secret Service, recommends that agents in the field take training programs run by mental health professionals. The agents need to learn, the committee says, about interview techniques, episodic aspects of certain mental disorders, and how mental disturbances are affected by different medications, alcohol abuse and life stresses. Field offices should line up local clinicians and institutions as consulting sources, the report adds.

Behavioral scientists, however, have little to offer when it comes to predicting who will carry out a threat of physical violence. "There are at present no scientifically valid models to predict who will be assassins," says the committee.

Under current procedures, any person whose words or actions bring him or her to the attention of the Secret Service may be investigated. Subjects of inquiries, who are often in mental hospitals or prisons, are interviewed and reassessed at least every 90 days.

To develop criteria for evaluating dangerousness, the report suggests that the Secret Service establish a continuing behavioral research program. As an initial step, it proposes expanding the data base for studies of assassinations by including related actions such as assassination attempts, stalking protected and unprotected persons and buying a gun after making threats. Another project could analyze the markers used by experienced agents to identify dangerous persons.

The committee cautions that ethical dilemmas may occur when mental health professionals work with Secret Service agents. A clinician's need to preserve the confidentiality of a patient's treatment and background, for example, may conflict with an agent's need for detailed information.