Machinery/Automation

Powder-Collection System for Ultrasonic/Sonic Drill/Corer

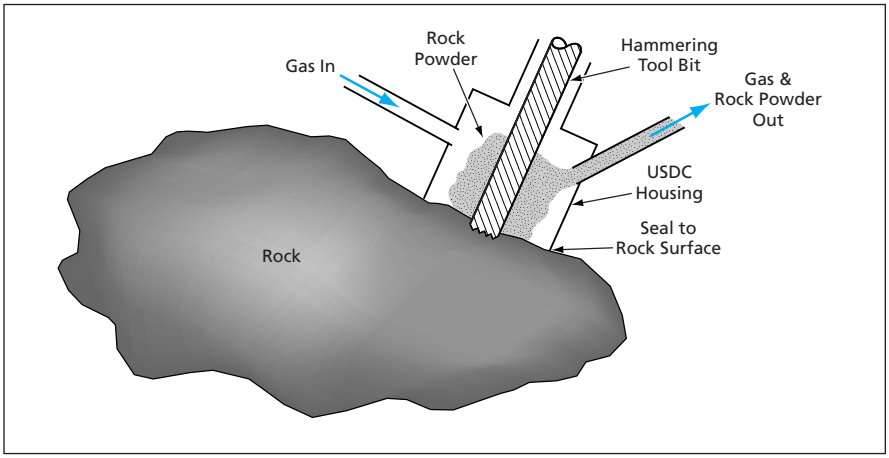
Powder is blown from the drill/rock interface to sampling locations.

NASA's Jet Propulsion Laboratory, Pasadena, California

A system for collecting samples of powdered rock has been devised for use in conjunction with an ultrasonic/sonic drill/corer (USDC)— a lightweight, low-power apparatus designed to cut into, and acquire samples of, rock or other hard material for scientific analysis. The USDC was described in "Ultrasonic/Sonic Drill/Corers With Integrated Sensors" (NPO-20856), *NASA Tech Briefs*, Vol. 25, No. 1 (January 2001), page 38. To recapitulate: The USDC includes a drill bit, corer, or other tool bit, in which ultrasonic and sonic vibrations are excited by an electronically driven piezoelectric actuator. The USDC advances into the rock or other material of interest by means of a hammering action and a resulting chiseling action at the tip of the tool bit. The hammering and chiseling actions are so effective that unlike in conventional twist drilling, a negligible amount of axial force is needed to make the USDC advance into the material. Also unlike a conventional twist drill, the USDC operates without need for torsional restraint, lubricant, or a sharp bit.

The USDC generates powder as a byproduct of the drilling or coring process. The purpose served by the present sample-collection system is to remove the powder from the tool-bit/rock interface and deliver the powder to one or more designated location(s) for analysis or storage.

The sample-collection system includes parts that are integrated into the USDC (see figure). The USDC is designed so that when the tool bit is brought into contact with the rock, a circular bellows or knife-edge seal at the lower end of the USDC housing is also pressed against the rock, partially sealing the volume enclosed by the USDC housing and the rock face. From time to time during operation of the tool bit, a high-pressure pulse of gas is blown into the volume through an inlet. The resulting flow of gas entrains particles of powder and carries them away through an outlet.



Powdered Rock is generated by the hammering action of the tool bit, then entrained in a high-pressure pulse of gas flowing from the inlet, through the outlet, to one or more location(s) for analysis or storage.

A screen along the path of the powder/gas mixture is used to trap particles above a predetermined size while allowing acceptably small particles to proceed. The powder can then be further processed in any of several ways. For example, it can be trapped on a porous or adhesive tape for delivery to an instrument or for storage, mixed with fluids by use of a sonicator, or blown into a heating chamber for thermal treatment and analysis.

This work was done by Stewart Sherrit, Yoseph Bar-Cohen, Xiaoqi Bao, and Zensheu Chang of Caltech for **NASA's Jet Propulsion Laboratory** *and by David Blake of Ames Research Center and Charles Bryson of Bryson Consulting for Ames Research Center. Further information is contained in a TSP (see page 1).*

NPO-40564

Semiautomated, Reproducible Batch Processing of Soy

Processing conditions are selectable and are consistent from batch to batch.

Lyndon B. Johnson Space Center, Houston, Texas

A computer-controlled apparatus processes batches of soybeans into one or more of a variety of food products, under conditions that can be chosen by the user and reproduced from batch to batch. Examples of products include soy milk, tofu, okara (an insoluble protein and fiber byproduct of soy milk), and whey. Most processing steps take place without intervention by the user. This apparatus was developed for use in research on processing of soy. It is also a prototype of other soy-processing apparatuses for research, industrial, and home use.

Prior soy-processing equipment includes household devices that automatically produce soy milk but do not automatically produce tofu. The designs of prior soy-processing equipment require users to manually transfer intermediate solid soy products and to press them manually and, hence, under conditions that are not consistent from batch to batch. Prior designs do not afford choices of processing conditions: Users cannot use previously developed soy-processing equipment to investigate the