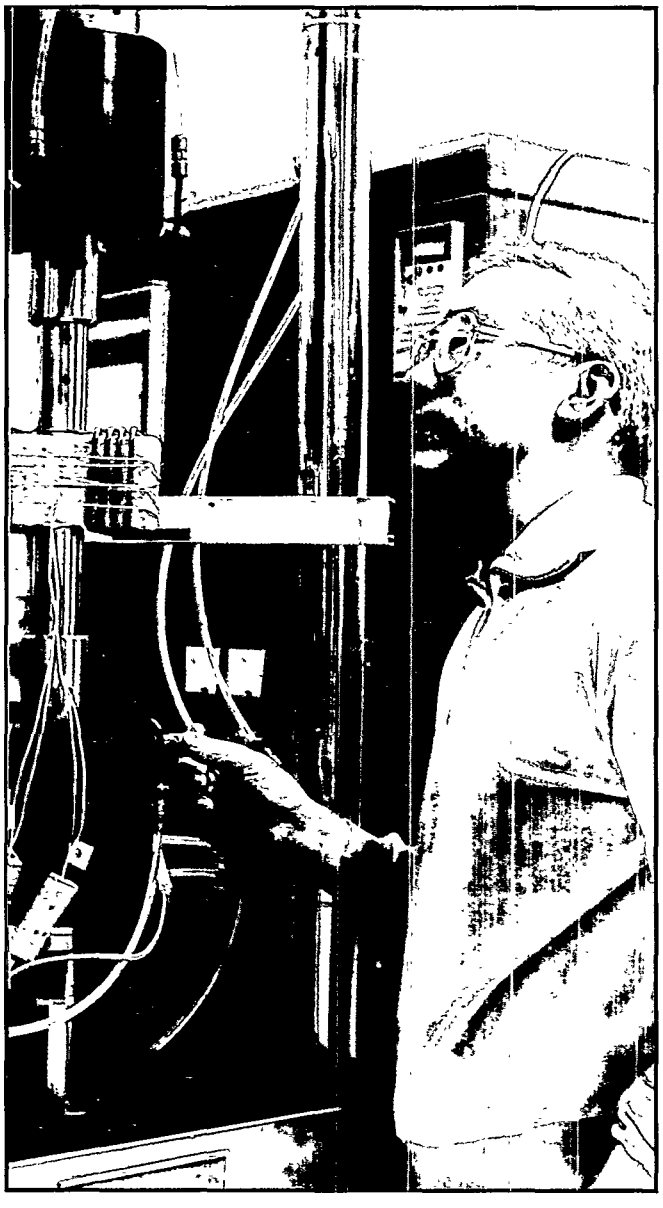
tained. Under the Advanced Materials Development program, DOE developed a high-temperature ceramic tensile test device with self-aligning grips. This hydraulic flexible coupling will not transmit bending moments and is completely self-aligning during a test, thus achieving the requirement for alignment on most testing machines. This testing methodology and the data generated will be critical to the designers of future advanced engines. The technology has been licensed to USA Instron and is being marketed as the "Super Grip System".



Dr. K.C. Liu, of Oak Ridge National Laboratory, using the "Super Grip System" to measure fatigue of ceramics at high temperatures.

Alumina-Based Ceramic

DOE has supported basic materials science research focused on developing high-strength, high-temperature materials for applications in automotive and light truck heat engines. Over the past six years, these research efforts have concentrated on developing alumina-based ceramic composite materials. As is often the case with basic research programs, successful results occurred in unanticipated areas. In this case, significant advancements in machine tool technology resulted from the alumina-based ceramics research. The composites developed possess many of the attributes required for automotive applications, but do not yet have sufficient high-temperature resistance. Alumina-based ceramics have been marketed for use in cutting tools and have potential applications for manufacturers of various products subject to mechanical wear (e.g. automotive parts). Cutting tools and machine tools that use this material demonstrate increased strength and improved performance compared with conventional machine tool technology. Oak Ridge National Laboratory (ORNL) has initiated an aggressive technology transfer program to disseminate alumina ceramic composite research program results. ORNL estimates that the industries identified above represent a $500 million dollar market and that licensing agreements can be reached with 80 percent of the firms in those industries. The benefits from development of this product will include royalties from licensing agreements with a variety of industries and substantial energy savings due to increased productivity, reduced weight and reduced levels of friction.

High Temperature Materials Laboratory

The efficiency of heat engines is limited by the ability of known materials to withstand stress under high temperatures. This materials factor restricts the efficiency and reliability of advanced energy conversion systems and is a barrier to high energy efficiency in many industrial processes. The DOE