IPRON – A SYSTEM FOR AUTOMATIC RECORDING OF THE BEHAVIOR OF A MATERIAL ON UNILATERAL HEATING

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A system is considered for automating research on the behavior of materials under different forms of unilateral heating; a structural diagram is given.

The behavior of a material on unilateral heating is usually examined manually, starting with experiment and finishing with the data processing. This is very time-consuming, particularly for highly skilled workers, and much of the information is wasted or cannot be utilized.

Automation of the experiment and data processing reduces the time involved and improves the output, while enabling one to perform essentially novel studies.

There are three typical schemes for experiment automation:

1) research systems (instruments) with built-in data-processing devices and display systems [1-4];

2) automated data-acquisition suites interfaced to computing systems [5, 6]; and

3) flexible modular highway systems of CAMAC, Hewlett-Packard, or Sector type, with modular software [7, 8].

The modular systems are becoming more widely used because of their obvious advantages: ready modification of system configuration, ease of expansion and increase in power, and ease of communication with the system.

The sole disadvantage of a highway system is the higher cost, but this is offset by the much greater facilities.

The Institute of Materials Science Problems of the Academy of Sciences of the Ukrainian SSR has built the IPRON system, which includes eight subsystems that can handle 39 different problems, 20 data-acquisition tasks, data storage and updating, and 15 tasks involving interaction with the machine.

Figure 1 shows the structural diagram of the system. The peripheral computer was an SM minicomputer, while the central computer was an M4030. The hierarchic structure relieves the central computer of the acquisition and preprocessing; it handles the storage and updating of the files, statistical processing, compilation of reports, formulation of experiment plans, and execution of computer experiments on the accumulated data.

The following specifications were laid down for the means of performing the experiments and recording the data:

1) the apparatus generates data at the rate of about 1.5 kbytes/sec;

2) the data rate in a channel can be up to 0.6 kbytes/sec; and

3) the ADC should be capable of about 1000 measurements per second.

The system has a modular highway structure that allows for expansion.

The IPRON system was designed to be a flexible research instrument providing for interaction with the researcher. The hierarchic structure allows several experiments to be performed together sequentially or by time sharing.

The system includes the following subsystems: one for examining the damage to materials on strong unilateral heating; a system for researching the behavior of models in a high-temperature gas jet; a unit for producing refractory materials by radiative heating; means of analyzing the production of films by high-temperature techniques (A by plasma-chemical reaction and B by deposition under vacuum); means of researching, welding, soldering, and cutting by means of concentrated radiation energy; a system for identifying and simulating high-temperature interactions, a means of storing and updating experimental information (data base), and service programs.

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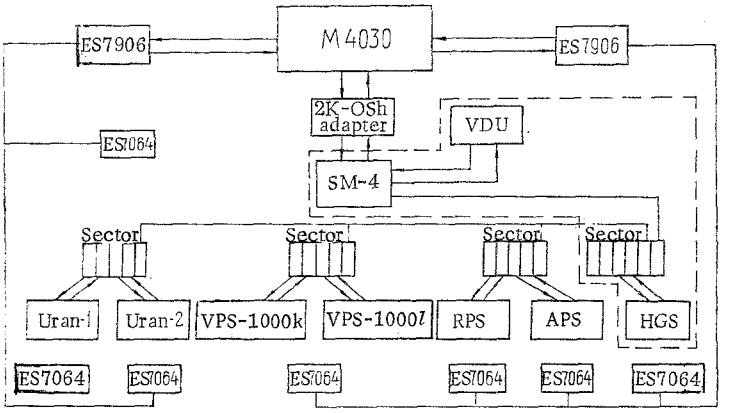

Fig. 1. Structural diagram of the IPRON system: VPS-1000k) coaxial plasma source; VPS-1000*l*) linear plasma source; RPS) radiation-plasma system; APS) arc-plasma system; HTS) high-temperature gasdynamic system.

These are primary systems designed for implementation in the near future. The basic system handles various jobs in the first and second subsystems related to the high-temperature gasdynamic system (shown by the broken line in Fig. 1). This basic system will be implemented in 1980 in accordance with the plan for automating research under the Academy of Sciences of the Ukrainian SSR and the forward plan for research automation of the Academy of Sciences of the USSR. The basic system is designed to use the modular Sector system and an SM-4 computer. This basic system performs automatic data acquisition, particularly the temperature at four or five points within a specimen and the temperature at the surface, automatic recording of fuel and oxygen flows, automatic control of these flows, determination of thermophysical characteristics of materials, and presentation of results as graphs and tables.

The entire system can be used to automate the testing of various systems and to manage working conditions, and the results from individual units can be documented.

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