ENGINEERING

Ceramals for Gas Turbines

➤ EARTHY substances combined with metals are the most promising alloys for use in the turbine engines of tomorrow's airplanes.

These new substances are called "ceramals" and they are used in the blades on the shafts of gas turbine engines where extreme high temperatures are encountered.

Much research into alloys and other materials needed to withstand the high temperatures within the gas turbine engine has been under way during the past decade, and particularly since the advent of the jet-propelled airplane.

A leading part in such work has been taken by the National Advisory Committee for Aeronautics. A review of NACA research on these ceramals has been issued by the Society of Automotive Engineers.

The report is by G. Mervin Ault and G. C. Deutsch, both of the Lewis Flight Propulsion Laboratory maintained by the NACA at Cleveland. It covers work done by them and others at this government institution whose primary concern is aircraft engines and fuels.

The high-temperature metal alloys now used in the blades on the shafts of turbines in both turbo-jet and turbo-prop engines are operating close to their upper temperature limits. Materials to withstand higher heat are necessary.

Ceramic blades show favorable strength at high temperatures, but they tend to fracture with sudden drastic temperature changes, a common occurrence in gas turbines. Ceramics also are brittle and difficult to handle without breakage.

The ceramals which were carefully investigated by the NACA included boron carbide ceramic to which iron was added, and titanium carbide which was used separately with cobalt, tungsten and molybdenum. The boron ceramic is one of the strongest; the titanium ceramic is the most resistant to shock.

The boron carbide-iron ceramal, 36% iron, has a strength consistently lower than that of pure boron carbide, but the rate of decrease in the ceramal's strength with increase in temperature is very low. At 2,400 degrees Fahrenheit, the ceramal lost only 27% of its room-temperature strength.

Titanium carbide ceramals containing cobalt were investigated extensively because cobalt was known to bond well with cemented-carbide tool compositions. Ceramals containing from 5% to 30% of the metal were used. The purpose of this was to determine the best mixture for the blading.

In bending tests, cobalt-bearing ceramals had exceptional strength up to 2,000 degrees Fahrenheit, but negligible strength at 2,400 degrees. The tungsten and molybdenum compositions, on the other hand, have only moderate strength at the lower temperatures but considerably surpassed the cobalt ceramal at 2,400 degrees.

A titanium carbide ceramal with 20% cobalt was found resistant to thermal shock. The cobalt-bearing bodies were found resistant to oxidation. From the tests, the scientists decided that the titanium carbide with 20% cobalt was the best to use in actual operation tests in an engine.

Science News Letter, June 3, 1950

GENERAL SCIENCE

Fear AEC Speech Controls May Extend Beyond H-bomb

➤ FEAR that attempts by the Atomic Energy Commission to control what scientists say about the hydrogen bomb will curb their willingness to discuss crucial political and military decisions was expressed in Chicago by Dr. Eugene Rabinowitch, editor of the BULLETIN OF THE ATOMIC SCIENTISTS (May).

Scientists in America should not become technical specialists working on topics without interest in the implication of their work for the future of the nation, Dr. Rabinowitch warned. They must have a feeling of obligation to take part in the formation of national policy.

"The initial success of totalitarian regimes in silencing all expression of independent opinion has been based only in part on actual reprisals or fear of reprisals," he said. "To a large extent it was founded on the unwillingness of most people to tangle with the police and censorship. It is simpler and safer to stick strictly to one's own business than to try to take part in public affairs if this participation is obviously frowned upon and surrounded by bothersome regulations."

"Scientists who have the most complete knowledge of the facts and the deepest understanding of the possibilities, have the right and the duty to participate. They alone are able to enlighten public opinion, and the judgment they have shown so far does not justify apprehension that they speak out too lightly or irresponsibly."

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