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THE EFFECT OF TEMPERATURE ON RTV-20[®]

by

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THE DOW CHEMICAL COMPANY
ROCKY FLATS DIVISION
U.S. ATOMIC ENERGY COMMISSION
CONTRACT AT (29-1) -1106

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Printed in USA. Price \$1.. Available from the Clearinghouse for Federal
Scientific and Technical Information, National Bureau of Standards,
U. S. Department of Commerce, Springfield, Virginia

10 August 1965

RFP-625

UC-25 METALS, CERAMICS,
AND MATERIALS

TID-4500 (43rd Ed.)

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ABSTRACT

This study reports upon the heat in the projector lamp beam of an optical comparator; the effect of this heat on RTV-20[®] and the reduction of these effects by use of an infrared filter.

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THE EFFECT OF TEMPERATURE ON RTV-20®

PURPOSE

This experiment was performed to study the heat produced by an optical comparator projector lamp; the effect of this heat upon the casting compound RTV-20®; and the effectiveness of a filter to reduce the thermal expansion of a cast.

TEST PROCEDURE

All dimensional data was taken on a Kodak Model 30 optical comparator. This 30-inch comparator (SSRL #3905) uses a 500 watt bulb and was operated with the 50X lens throughout the experiment.

A laboratory quality mercury thermometer, with 1/2°F graduations, was used to record the temperatures.

The temperature produced by the light beam was first investigated. The thermometer was centered in the light beam, at the object focal point and at right angles to the optical axis. The increase in temperature with respect to time was recorded.

The effect of heat absorption of the casting material was measured by encasing the thermometer bulb in a 1" x 1" square cast. This cast was placed at the point of inspection and rate of temperature increase was observed.

The coefficient of expansion of the casting compound was also investigated. Two casts were formed around the bulb of the thermometer. One was a 1/2" diameter cylinder, the other was a 1" x 1" square. The change in size with temperature of each of these casts

was recorded by the use of the optical comparator measuring system.

An attempt was made to reduce the heating effect of the beam by filtering out the infrared radiation. A green filter glass was placed in the light beam between the lamp and the cast at a position approximately two inches from the cast. The rate of change of temperature and the terminal temperature obtained without the filter was compared with those obtained with the filter.

RESULTS

The results of these measurements are shown in the following graphs.

Graph 1A shows the temperature versus time relationship for the bare bulb thermometer.

Graph 1B shows the temperature versus time relationship of the 1" x 1" square casting.

Graph 2A shows the change in dimension of the 1/2" diameter casting with changes in temperature. A more precise temperature measuring technique will be used in future experiments to obtain more accurate determinations of the thermal coefficient of expansion of RTV-20[®]. This experiment was designed to determine qualitative effects only.

Graph 2B shows the change in dimension of the 1" x 1" square casting.

Graph 3A shows the temperature versus time relationship of the 1" x 1" square casting without the green filter.

Graph 3B shows the temperature versus time relationship of the 1" x 1" square casting with the green filter placed 2" in front of the casting. The decrease in light intensity caused by the filter was negligible.

CONCLUSIONS

These results show that:

1. The optical comparator light beam has significant heat producing radiation.
2. The RTV-20[®] compounds are heat absorbers.
3. The coefficient of thermal expansion is such that significant errors are possible with the use of this method of measurement.
4. The use of green filters reduce but do not eliminate the temperature absorption effects.

GRAPH 1A

Thermometer centered in collimated light beam
of optical comparator at its focal point.

GRAPH 1B

1" x 1" absorption surface of RTV 20 casting compound placed on thermometer, centered in light beam at point of focus.

GRAPH 2A

Experimental value of coefficient of expansion of 1/2" diameter cast cylinder of RTV 20. Sample placed in thermometer in light beam of comparator.

GRAPH 2B

Experimental value of coefficient of expansion,
1" square cast of RTV 20 on thermometer.

GRAPH 3A

1" x 1" square absorption surface of RTV 20 casting compound placed on thermometer, centered in light beam without green glass filter.

GRAPH 3B

1" x 1" square absorption surface of RTV 20 casting compound placed on thermometer, centered in light beam with green glass filter.