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ENVIRONMENTAL TESTING LABORATORY

STRAIN GAGE APPLICATIONS USING
THE ROKIDE PROCESS

By

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PURPOSE

This report will be presented at the ninth meeting of the IMOG Subgroup on Environmental Testing held at the Mason-Hanger Company, Amarillo, Texas, September 14-15, 1965.

INTRODUCTION

During the past few years some of our strain gage applications have presented difficulties when attaching gages to certain materials under unusual conditions. We feel that our new Rokide system will help solve a good many of these problems. In presenting this report I would like to mention some of these applications and how the Rokide Process will provide solutions to them. I would also like to go over the advantages and disadvantages of the equipment.

DISCUSSION

Strain Gage Applications

Some of the strain gage applications that our Lab has been called on to do have required readings at high temperature and over long periods of time. This has demanded that our strain gage technique be constantly improved. Some of the applications and problems that have pointed out our needs are as follows:

1. Strain gaging plutonium coupons that were to be tested to 750°F.
2. Strain gaging units that demand dependability over long periods of time.

3. Strain gaging pressure vessels on our plant site so they could be checked periodically for periods of 5 to 10 years.
4. Need to keep organic materials away from certain types of material.
5. Quick dependable means of attaching gages to radioactive material in order to decrease exposure time.
6. Have a uniform method to attach gages to various types of material.

In looking over the available equipment during the past two years we found that the flame spraying technique had been used, but contained two serious problems, which were namely:

1. Equipment was massive and hard to handle.
2. Refractory materials were not pure enough to give good electrical isolation.

BLH and Norton companies worked together and refined the Rokide Process eliminating these two problems.

Advantages of Rokide Process

The advantages of the Rokide Process are:

1. No loss of information during curing - most high temperature adhesives require at least two hours cure time at 600°F. Many times this results in losing first cycle information.
2. High temperature capabilities - the Rokide Process will permit testing up to 1500°F. Figure 1 shows curves of four different refractory materials.
3. Inorganic - the refractory material is pure aluminum oxide. No organic material is present.

4. Portability - system is completely contained on a cart and can be moved to any area as required.
5. Speed - a gage can be installed in five minutes using the Rokide Process.
6. Versatility - the process can be used on most materials such as all metals, ceramics, rock, etc.
7. Low temperature installation - the part that the gage is being applied to can be kept to 200°F or lower during installation. Eliminating any possibility of annealing the test specimen.

Disadvantages of Rokide System

The disadvantages of the system are few and most of them can be overcome by simple precautions. The disadvantages that we are aware of are as follows:

1. Reinforcing - the aluminum oxide build-up may provide a reinforcing effect which could be detrimental on thin samples.
2. Humidity - the refractory material has an affinity for water and will absorb moisture from air. In high humidity atmospheres a waterproof coating will be necessary. We do not have any problem with this since most of our applications and testing is done in dry air.
3. License agreement - the Rokide Process is patented and a license is necessary before the equipment can be purchased. An accurate account of the refractory material used must be kept and a royalty paid.

4. Expansion of Rokide material - the refractory material is limited to approximately 1% elongation. This is sufficient for most applications.

Rokide Equipment

Figure 2 shows a schematic drawing of the flame spray equipment. The refractory material is fed into the flame spray gun where it is melted by an oxygen-acetylene flame. The air pressure sprays the molten material onto the strain gage thus holding it to the test surface.

Gage Application

Photograph No. 1 shows the different stages of attaching a strain gage with the Rokide Process. The different steps involved are as follows:

1. Selection of the proper gage - any gage free of backing can be attached.
2. Preparing and pre-coating the test sample - the area to be gaged needs to have all grease and heavy oil removed, must be uniform, and free of deep tool marks or scratches. The area is then sandblasted with a clean aluminum oxide grit. After the area is cleaned a pre-coat is sprayed on it. This is done by masking off the proper area. The pre-coat should be .002 to .004 inches thick.
3. Positioning the gage - after selecting the proper gage, the protective paper has to be removed. The gage, with its grid carrier, is then located on the test specimen with the grid wires in contact with the pre-coat. The lead wires are then masked with a pressure sensitive tape made of Teflon FEP-fluorocarbon.

4. Gage tack down - the next step is to spray sufficient Rokide to tack down the exposed end loops and lead wires of the strain gage to the specimen surface. After the gage is tacked down the grid carrier is removed.
5. Final coat - with the grid carrier removed the gage and exposed lead wires should be sprayed until they are covered.

After these five operations or steps the remaining masking is removed and proper lead wires are attached.

CONCLUSIONS

The Rokide Process seems to be an answer to many problems encountered in attaching strain gages and temperature sensors. Our biggest problem, which gave us justification for obtaining the system, has been attaching gages for high temperature work. The other advantages that were mentioned may prove to be as important as test requirements become more stringent and our experience increases.

GAGE TYPE: HT-1235-4A
PRECOAT THICKNESS: 3 TO 4 MILS

FIGURE 1. TEMPERATURE VERSUS RESISTANCE TO GROUND

SCHEMATIC DRAWING OF FLAME SPRAYING EQUIP

FIGURE 2

1. FREE ELEMENT STRAIN
GAGE WITH PROTECTIVE
PAPER IN PLACE

2. TEST SPECIMEN
PRECOATED AND
MASKED

3. STRAIN GAGE
LOCATED ON
TEST SPECIMEN

4. STRAIN GAGE
TACKED DOWN

5. STRAIN GAGE
TACKED DOWN
WITH GRID
CARRIER
REMOVED

6. STRAIN GAGE AND
SPECIMEN WITH
FINAL COAT

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