

# POSTER

## CHEMICAL RESISTIVITY OF SOME SiC/GRAPHITE COMPOSITES IN ACIDIC AND BASIC CONDITIONS

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### INTRODUCTION

Carbon materials have very strong resistivities to acidic and basic chemical reagents. Many types of carbon based composites are used in industry and many other areas. Sometimes, these materials are the cause of machine troubles. Few studies have been done on the chemical resistivity of these materials.

In the present paper, we used 5 kinds of SiC/C composites and studied chemical resistivities to acidic and basic conditions at room temperature(RT). Results suggest that materials should be selected according to the conditions they will be used in.

### EXPERIMENTAL

The following 5 kinds of SiC and SiC/C composites

were used: SiC-1H: porous SiC only  
SiC-2G: SiC/Si composite  
SiC-3J: SiC/C composite, non-porous SiC  
SiC-4I: SiC coated graphite block.  
SiC-5K: SiC coated graphite block using CVD.

Test piece size: 10 × 10 × 60 mm.

Reagents: sulfuric acid(98%) (H<sub>2</sub>SO<sub>4</sub>)  
nitric acid(38%) (HNO<sub>3</sub>-38)  
nitric acid (61%) (HNO<sub>3</sub>-61)  
hydrochloric acid(36%) (HCl)  
potassium hydroxide(60 wt%) (KOH).

Liquid reagents temperature: RT(20°C).

Period: 1 week, 1 month and 2 months.

Procedure: test pieces were washed in an ultrasonic washer by pure water, and dried at 105°C for 2 hours. This process was repeated until constant weight was obtained. After pre-tests, the pieces were immersed in the reagents for the test periods. At the end of every test period, the constant weight was obtained again and each piece was tested for appearance, weight and size. Finally, after the last test period, the samples were tested for appearance, weight, size, bending strength, and SEM picture.

### RESULTS AND DISCUSSIONS

SiC shows high resistivity for many acidic and basic chemical reagents, but some problems occur with the composite materials.

Figure 1 summarizes the weight change ratio of the samples in every test period and every reagent.

SiC-1H shows 0.001 or less weight loss after 2 months immersion. The conditions and reagents of this experiment did not change pure SiC.

SiC-2G shows 0.0001 or less weight loss during the 2 month test period on all samples, except the KOH samples. The KOH samples show great weight loss of 0.0034, 0.0087, and 0.0134 for 1 week, 1 month and 2 months, respectively. And the Si pattern in X-ray diffraction disappears after 2 months. Those results

suggested that Si dissolved in KOH and only SiC remained.

SiC-3J shows 0.0003 or less weight loss on all samples. Those results suggest that non-porous SiC/C composite materials have strong resistivity to acidic and basic conditions.

SiC-4I shows three types of weight changes. First, HNO<sub>3</sub>-61 weight increased on 1 week samples to 1.0019, but after 2 months, the weight decreased to 1.0005. Second, H<sub>2</sub>SO<sub>4</sub> shows great weight increases to 1.0089, 1.0167, and 1.0453 for 1 week, 1 month and 2 months, respectively. Third, during the 2 month test period, the weight change in HNO<sub>3</sub>-38, HCl, and KOH was 0.0002 or less. And sometimes small cracks occurred on the surface of the test pieces. There is a strong bonding between carbon and SiC in this composite, but a SiC coated structure is porous. Those results suggested that porous SiC is not a good composite materials in liquid conditions.

SiC-5K shows three types of weight changes. First, HNO<sub>3</sub>-38, and HNO<sub>3</sub>-61 weight increased to 0.0008 or less for all test periods. Second, H<sub>2</sub>SO<sub>4</sub> increased to 1.0021, 1.0098, and 1.0696 for 1 week, 1 month and 2 months, respectively. Third, in HCl and KOH, the 2 month samples show weight changes of 0.0002 or less and in the KOH samples, the color changed from silver to green. This composite is coated with non-porous SiC, so there is good resistivity to gas and solid conditions, but in liquid conditions some troubles occurred, because the liquid seeped inside through small cracks on the surface.

### CONCLUSIONS

- 1) SiC has high resistivity to acidic and basic conditions. Si dissolves in KOH solution.
- 2) coated non-porous SiC has good resistivity in acidic and basic solutions.
- 3) coated porous-SiC has resistivity in acidic and basic conditions, but sometimes surface cracks induced deformation.
- 4) SiC/C composites show excellent characteristics in dry conditions, but some troubles occur in liquid conditions,

because of there own characteristics and small defects in the composite structures through poor quality control.

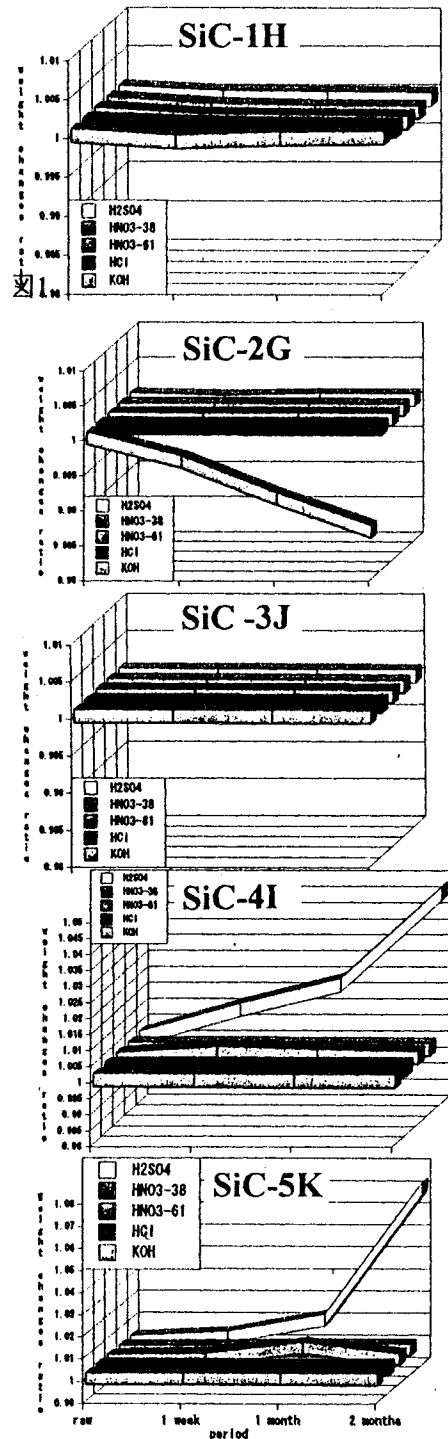


Figure 1. Weight change ratio of SiC composites of 1 week, 1 month and 2 months.