Corrosion behavior of KFRP at high temperature dry-wet cycle in salt water

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Abstract

Kevlar fiber reinforced epoxy composites (KFRP) were tested at high temperature dry-wet cycle in salt water condition. The moisture uptake behavior, flexure strength and barcol hardness of KFRP were studied. It was concluded that corrosion velocity of KFRP was accelerated largely at high temperature dry-wet cycle in salt water condition.

Keywords: Kevlar fiber, corrosion, high temperature, dry-wet cycle, salt water

Introduction

Kevlar fiber was used widely as an organic fiber because of its high strength and modulus. There have been a few investigations in the effect of moisture on Kevlar fiber reinforced composites [1-4]. However, there are few literature studied the corrosion behavior of Kevlar fiber reinforced composites at high temperature dry-wet cycle condition, especially at salt water condition. In this paper, the corrosion behavior of Kevlar fiber reinforced epoxy composites was studied at 100℃ dry-wet cycle in salt water condition.

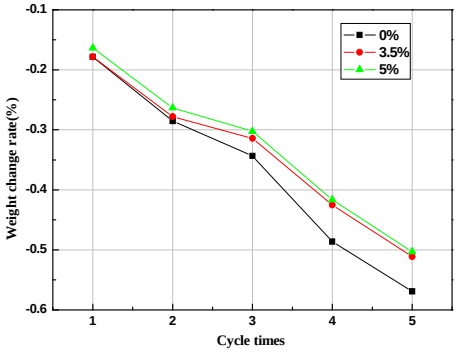
Experimental

The composites were fabricated by winding molding and then were immersed in salt water at 100℃. According to our former experiments, we choose 3 hours for a cycle period. Then the specimens were put into oven at 90℃ for the same period. This procedure was repeated for several times. The weights of the composites were recorded in such periods. Moisture uptake tests were conducted according to HB7401-96. Flexural strength tests were carried out by a universal tester according to GB/T 1449-2005. Barcol hardness measurements were carried out with HBa-1 type Barcol hardness tester according to GB/T 3854-2005.

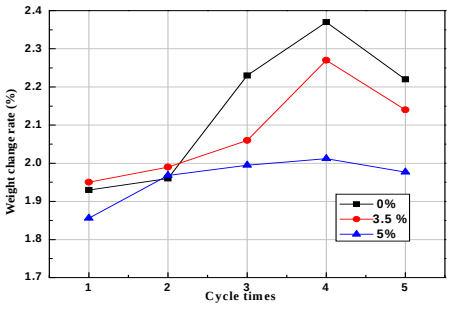
Results and discussions

Moisture uptake tests

The weight change rate of the specimens



(a)



(b)

Fig. 1. Weight change rate of specimens (a) dry state; (b) wet state

in dry state and wet state are presented in Fig. 1. Fig. 1(a) is the specimens at dry state, and Fig. 1(b) is the specimens

at wet state. From the Fig. 1, it can be seen that the weight change rate decreased sharply in high temperature dry-wet cycle tests. It is evident that not only physical corrosion but also chemistry corrosion happened on the specimens at 3 hours cycle period high temperature dry-wet cycle tests.

Flexural strength

The retention rate of flexural strength of KFRP composites at high temperature dry-wet cycle conditions are shown in Fig. 2. The salinity of the solution was higher, and the flexural strength was lower. Because the high salinity reduced the velocity of take up water. It also revealed high salinity decreased corrosion degree. All the flexural strength of KFRP composites decreased with time increased were also can be

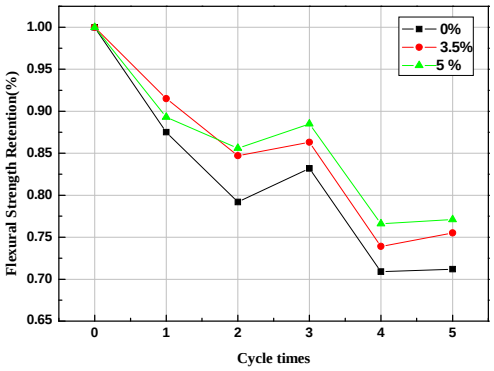


Fig. 2. Retention rate of flexural strength of KFRP composites

concluded. After the fourth dry-wet cycle tests, the flexural strength show increasing trend because of post cure process.

Barcol hardness

The hardness of KFRP composites at high temperature dry-wet cycle conditions are shown in Fig. 3.

From Fig. 3, it was investigated that barcol hardness reduced when the corrosion time increased. When the composites immersed in the salt water for a long time, the bonding of the interface was broken.

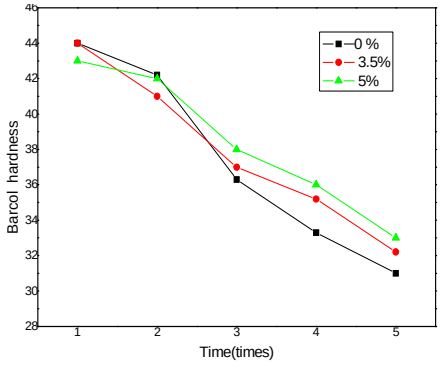


Fig. 3. Barcol hardness of KFRP composites

Conclusions

High temperature dry-wet cycle tests in salt water were studied in this paper.

(1) The weight change rate decreased sharply with the corrosion time increased.

(2) The salinity of the solution is higher, and the variation of flexural strength of KFRP composites is lower.

(3) Barcol hardness reduced with the corrosion time increased.

References

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